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Some Recent Advances in Veterinary Helminthology.*

By Thomas W. M. Cameron. M.A., B.Sc., Ph.D., M.R.C.V.S., Assistant in Helminthology, London School of Hygiene and Tropical Medicine.

This paper is not intended to be a complete résumé of all the work which has taken place in helminthology during the last decade; but is merely an attempt to place before the practitioner such of the more recent discoveries in worm parasites of the domestic animals, their prevention and cure, as the writer considers to be of most outstanding interest to the veterinary surgeon. The subject is one of such magnitude, and the recent work has been so extensive, that only the more important of the scientific advances can be mentioned.

Every practitioner is familiar with helminths and their effects; so that there is no need to stress the symptomatology of helminthiasis. The effects of helminths are not always directly evident, but the loss in work and flesh—and consequently in beef, mutton, and pork—and the decreased resistance to other diseases are not always so obviously due to the parasites. Yet the loss from these causes, although slight in any one animal, must in the aggregate, in a stock-rearing country such as this, amount to millions of pounds annually.

It is the aim of the veterinary surgeon to cure animals suffering from parasitic diseases; but it is even more important to prevent infection occurring, and for this purpose a certain amount of detailed information is essential. In the first place he must be able to diagnose the parasite present. Once diagnosed the name is merely an index which will reveal to him its life history, its peculiar habits and its weaknesses. He must also be able to kill or at least remove the parasite from the animal body and as far as possible prevent it from returning. Let us then consider the general plan of action in some detail and the important discoveries which science has made within the last few years which bear on these points.

Diagnosis.—So far as is at present known, no animal parasite can multiply inside its host. In this respect parasites differ fundamentally from the bacteria. Some part at least of their life-cycle must be passed outside the body. The female worm lays eggs, or in a few cases produces living larvæ. Eggs and larvæ are always passed to the exterior in the droppings, urine or sputum. (Larvæ may pass to the muscles—as in Trichinella; or to the blood-stream—as in Filaria.) Accordingly an examination of one or other of these media will enable a diagnosis of the kind of worm present to be made. So far as the parasites in this country are concerned, a fæcal examination is by far the most important. The simplest means of detection of parasitic eggs and larvæ in this medium, is to spread a small quantity of fæces on a glass slide, dilute it with a small quantity of water or saline and examine it under a ⅔in. objective. Many elaborate methods have since been described, but for most practical purposes this technique is sufficient for the practitioner. A very light infection may be overlooked, but it is only in exceptional circumstances that a very light infection has any significance, and in this case laboratory aid must be called in. Helminth ova are not distributed evenly throughout the fæcal mass, and in the case of the first slide not shewing any eggs, at least three other slides should be examined before a negative diagnosis should be given. A very good and alternative method for use in these cases is as follows: A small quantity of fæces is emulsified in a saturated solution of common salt by shaking vigorously in a test-tube. This is then filtered through a small copper wire sieve (100 meshes to the inch) into a conical Erlenmeyer flask, which then is filled to the brim with the salt solution. If left to stand for about a quarter of an hour the eggs will rise to the surface, and a wire loop dipped under the surface will remove them to a glass slide. About three loopfuls should be this taken, a cover-slip placed on the drop and the preparation examined under the microscope. An alternative method is to sieve the fæces, mixed with water into a conical urine tube in which is placed some ordinary water. This will enable all the coarse material to be removed, and if the mixture is allowed to stand for ten minutes or so, the eggs will fall to the bottom and the supernatent fluid may be decanted off and the sediment examined. This is especially useful for fluke eggs which do not rise in the salt solution.

The more elaborate methods described are only suitable for laboratory use, and for more accurate estimations of the number of ova present than are necessary for a diagnosis of helminthiasis. Every parasite passes eggs (or larvæ) of a constant shape, size and design and a knowledge of these is essential in order to diagnose with certainty the type of worm present and to apply the necessary curative and preventive measures. A knowledge of the appearance of ova is much more important to the practitioner than is the knowledge of the anatomy and classification of the adult worm.

A series of surveys have recently been carried out in this country by the Institute of Agricultural Parasitology, and we now know fairly definitely what species occur in Britain in the various domestic animals.

This is of considerable value in assisting identification, and it is of course essential to know—especially from the point of view of prevention—what parasites are common and what are rare. It is not possible to

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discuss these in detail, but those who are interested may be referred to the *Journal of Helminthology*, where they will find full particulars.

Morphology.—Before an exact knowledge of prevention and treatment can be obtained it is necessary to have an exact knowledge of the morphology of each species. Two closely-allied species may have very different life-cycles and may react in a different degree to various anthelminthics. We have seen that the identification of worms is merely an index to the information available as to its life-history and susceptibilities, and it is obvious that to be of any use this index must be an exact one. It is only since helminthologists have commenced to study the morphology of various worms in detail that this exact information has become available. The most outstanding example of this is the increase in the number of species of the sclerostomes of the horse from two to over fifty—not from the discovery of new forms so much as from the detailed examination of the common forms—and the recognition which followed from the use of the microscope, that all those of the same size were not necessarily of the same species. At one time all those forms were referred to "*Sclerostoma armatum*" or to "*Sclerostoma tetracanthum*," and now both these terms have disappeared into the limbo of forgotten things and their places taken by the genera Strongylus, Triodontophorus, Trichonema, Oesophagodontus, Gyalocephalus, Poteriostomum, Cylindropharynx and others. These genera contain at least fifty species, some of them rare but many common. The genera are easily recognisable from the shape of the mouth capsule, and there is no excuse nowadays for an incorrect generic diagnosis of the horse sclerostomes.

Morphological studies have also enabled us to trace affinities otherwise not obvious, and so help in the work of the elucidation of life-cycles and prevention.

Morphology then is not only a means for diagnosis but anassistance to prophylaxis, and must be considered as one of the foundation stones to our superstructure of knowledge.

It may be of interest to draw attention here to what appears to be the continual change of names in helminthology. This change is more apparent than real in many cases. One of the most important of modern advances has been the creation of a set of rules of nomenclature. At one time if a scientist did not like a name or considered it inappropriate he changed it, and the result brought the greatest confusion into literature. Now it has been decided that a specific name once given cannot be changed unless the same name has previoulsy been given to another species in the same genus. This harking back to the original name has produced a certain amount of temporary confusion, but the result will be of incalculable benefit to workers in the future.

Life-Histories.—Having recognised the worms present from the ova it is necessary to consider what measures are to be taken to prevent infection. To do this we must be acquainted with the salient features of the life-cycle. Many advances have been made in recent years in this branch of helminthology, but many gaps still remain and a considerable amount of work is in progress.

Flukes: The only fluke of importance in these islands is *Fasciola hepatica*, the well-known liver fluke of sheep, cattle and other animals. Its life-cycle is too well known to require description here. The most important of recent work in connection with this parasite has been the discovery of the fact that a very weak solution of copper sulphate (1 in 1,000,000) is sufficient to kill the intermediate host. A solution of this strength is harmless for domestic animals or man. It is, however, pathogenic for fish.

All other flukes have been found to have a similar life-history to that of the liver fluke, at least so far as the cercaria stage. Ciurea has recently shewn that the intestinal and liver flukes of dogs and cats in Europe become encysted as carcariæ on the scales or in the flesh of various fresh water fish, and infection is caused by eating the uncooked fish. It is of interest to note that many of those flukes may be transmitted to man by the same method.

Tapeworms: The cestodes are of more importance in this country than are the flukes, especially those of the dog. The more important of recent work has been that on the evolution of hydatid—a matter of very considerable importance in meat inspection.

The adult tapeworm—*Echinococcus granulosus*—is under half an inch long, and in this country is found in the intestine of the dog and the fox. Eggs are passed in the fæces and are ingested by some other mammal—man, horse, pig, cattle, sheep—and in these hosts develop into the well-known hydatid. It is very common in Britain, as in all pastoral countries, and apart from its public health significance is a source of considerable damage to the stock breeder. In certain countries in Europe it has made the intensive fattening of sheep imperative in order to avoid the loss due to the early death from the cyst if they were allowed time to fatten in the usual way. In addition to the extra expense to which the farmer is put by this intensive feeding he has to suffer the loss due to the condemnation of livers and so on.

The appearance of the hydatid is familiar to you all. It is a stout-walled cyst. In the inside there is a thin layer of nucleated cells (germinal layer). Surrounding this is a thick striated layer secreted by the cyst for its own protection, and outside this again is a third fibrous layer formed by the host organ as a defensive reaction against the parasite. From the germinal layer project many minute cysts (the brood capsules) each containing several immature tapeworm heads (the solices) each of which on being swallowed by a dog or fox develops into a perfect tapeworm. These tapeworms are accordingly always present in large numbers.

The recent work on the subject of hydatid has been chiefly directed towards following the progress of the egg after it has entered the body of the intermediate host.

Development of Hydatid.—Dew, working on young pigs, has been able to shew that eight hours after infection, the parasite appears in the portal vein, and four hours later has reached the liver. There is a

cellular reaction on the part of the host and the parasite is soon completely hidden by the cell accumulation and in some cases overcome. If not overcome it becomes vesicular, and in about three weeks it has become just visible to the naked eye. In three months it is 40-50 mm. in diameter and has a well-developed laminated membrane. Within the next two months it doubles its size ; the liver cells in contact with the cyst atrophy and are replaced by fibrous tissue, and the cyst, although still without brood capsules, is easily recognisable as a hydatid. All the structures in the hydatid develop from the germinal layer. The *brood capsules* first appear as small nucleated masses which grow and become vacuolated. On the inner surface of the brood capsules, thickenings occur which later become the solices. These solices never appear on the outside of the brood capsule—the external solices shewn in the text-books are due to a rupture of the capsule and its consequent evolution.

Daughter Cysts, which are identical with the mother cyst in histology, may be internal or external, and their development has been worked out by Dévé in France. The internal cysts occur as the result of the degeneration of a scolex—occasionally from the germinal layer direct. They are common in man but uncommon in the domestic animals. The external daughter cysts, on the other hand, are rare in man, but common in cattle and other animals. They arise as small islets of germinal layer which, owing to the irregularity of the development of the mother cysts, have become enclosed by the striated cuticular layer. This layer is continually being exfoliated and replaced from inside. Consequently, the islet gradually reaches the exterior of the cyst, where it develops in an exactly similar method to the mother cyst.

Dévé has shewn that both types of daughter cysts are abnormal and are only produced under conditions inimical to the continued development of the mother cyst.

The other tapeworms of the dog have life-cycles sufficiently well-known to render further reference unnecessary. One, however, *Taenia ovis*, passes its cystic stage in the muscles of the *sheep* and superficially resembles the cysts of measles in pig and ox. These latter cysts develop only in man, and are important in meat inspection. *C. ovis* completes its development only in the dog and is unimportant from that point of view. *C. bovis*, the intermediate stage of *T. saginata* of man, is not uncommon in Britain ; but *C. cellulose* of the pig appears to be absent. *T. ovis* also does not appear to be very common here.

Tapeworms in horses are also of interest and much more common in Britain than is generally recognised. The most important form lives in the cæcum and large intestine and is responsible for large ulcerated patches. These cause a layer of bloodstained mucus to be deposited in the formed stool passed by the animal. Their life-cycle is unknown.

Roundworms : Ascarid worms are present in all of our domestic animals, but the cattle form is of little importance in this country; and in sheep, ascarids are found so seldom as to be negligible.

In pigs, horses, dogs and cats, however, it is one of the commonest and most prevalent parasites throughout the world. Recent work has shewn that the life-cycle of all the forms is essentially the same. An unsegmented egg is passed in the fæces. After some weeks' exposure to oxygen a small embryo develops, but does not hatch until the thick-shelled egg is swallowed by the host and the embryo is liberated. The larvæ leaves the digestive tract for the blood stream, and in 4-6 days after ingestion, it reaches the lungs. Owing to its size it is too large to pass through the lung capillaries and accordingly it breaks through into the air spaces, passes up the trachea and is for a second time swallowed. Apparently, *any* species of ascaris will develop thus far in any host—Ortlepp has even found that snake ascarids will reach this stage in mice. If the host is not the correct one, the larvæ are passed to the exterior in the fæces ; if it is correct they develop to maturity in the intestine.

During the passage through the lungs, small areas of inflammation are caused, and if the larvæ are numerous—as they often are in pig-styes for example—a pronounced verminous pneumonia is caused. The animal may die or, if young, may have its growth at a very critical period seriously retarded. This has been found to be the case particularly in pigs, and has explained many cases of lung trouble and stunted growth in young animals.

Oxyuris equi is a very common parasite of horses. It is found in the large intestine, and as the adult feeds mostly on vegetable remains it is generally regarded as more or less inoffensive. Le Roux has recently shewn, however, that the larvæ are active blood suckers, and their activities in this direction may well cause a certain amount of damage. The females deposit their eggs on leaving the large intestine and reaching the exterior. The majority stop at the edge of the anus, being retained by their tail, and the eggs are ejected as the result of uterine peristalsis in a sticky mass onto the perineum and inner surface of the tail. The female then dies and dries up. This viscous oviferous material causes intense pruritis in the peri-anal region with excoriation of the perineum and depilation of the tail, and the horse may become emaciated and even unmanageable as a result of the irritation. It is continually rubbing its hind quarters against anything which presents itself, and so aids in the distribution of the ova. The eggs quickly develop on the warm skin, and within 48 hours—generally less—they contain an embryo. After 4-8 days, the eggs drop off from the skin and with the manure are further distributed. Water does not appear to be essential for the development of these eggs, but oxygen is necessary. The eggs on being swallowed hatch in the small intestine, and after moulting settle down in the cæcum. Eggs cannot develop without first reaching the air, and this is an essential condition for infection.

The *Sclerostomes* in the horse are a very mixed group, containing five or six genera and over fifty species. Unfortunately, while practically all horses are infected to some extent, no horse ever harbours a pure infection.

Some species probably cause little or no harm—although Le Roux's work shews that more are harmful than has been previously believed to be the case. On the other hand the genera Strongylus and Triodontophorus contain only definite pathogenic forms, while many species of Trichonema (Cylicostomum) are blood suckers when adult and live as larvæ part of their life in or under the mucous membrane of the large intestine and cæcum. The continual plurality of infection has caused the condition associated with the presence of these worms to be known as Strongylidosis or Sclerostomiasis. (The name *Sclerostoma* is an obselete synonym for the genus *Strongylus*, but it can conveniently be used for the *group* containing the genera referred to above.) There is a further technical drawback caused by this plurality of infection. It is impossible to study scientifically the life-cycle as can be done with other forms in other animals, by rearing larvæ from eggs found in the fæces, as owing to the similarity of all the sclerostome ova one never knows the species with which one is dealing. Consequently our knowledge is extremely limited.

Triodontophorus tenuicollis is one of the few sclerostomes which we can definitely associate in its adult stage with specific lesions. It is always found—frequently in very large numbers (over 500 worms have been collected from a single ulcer)—on ulcers formed in the right dorsal colon. These ulcers may be large and isolated, or small and multiple, arranged along the course of the dorsal cœlic artery. There is no doubt as to its pathogenic effects and its blood sucking habits. Dr. Ortlepp has recently published an account of its life history. All the details are not yet known, but the general outline is as follows. The eggs passed in the fæces hatch in about thirty hours. The small larva feeds and moults twice. At the last moult it remains within its cast skin and is in the infective stage. This takes about four days at 26°C. These infective larva can climb up grass, are very resistant to drying and can survive temperatures from 8°C. below zero to 60°C. above. They do not penetrate the skin, and infection is presumably by feeding—either on grass or in hay. After establishing itself in the intestine, the larva continues its growth, develops a provisional mouth capsule somewhat similar to the adult, and finally moulting again become mature. It does not seem to have an extra-intestinal stage such as has Strongylus. The other species of this genus probably have a somewhat similar method of development.

Three species of the genus Strongylus—*S. vulgaris*, *S. edentatus* and *S. equinus*—occur in horses in this country. The first part of their life history seems to be similar to that of Triodontophorus. Like that genus they are extremely resistant to drying and variations in temperature and like it gain access to the body through the food. Their subsequent life-cycle, however, is not so straight forward. According to de Blieck, the larva of *S. vulgaris* pierces the intestinal wall, shedding its loose skin in the passage, and is carried by the blood stream to the ilio-cæco-colic artery (occasionally to others) where they are the direct cause of the aneurisms so frequently the cause of a fatal colic in young horses. There they grow, and moulting, become young adults and make their way back to the intestine, where they take up their permanent habitat. The immature adults are often found in sub-mucous cysts in the cæcum.

The larvæ of the other two species seem to have similar cycles, but are carried by the blood stream to different localities. In the case of *S. edentatus*, this is normally under the parietal peritoneum, although specimens have been recovered from the liver parenchyma, in the connective tissue of the ventral cœlic vessels and elsewhere; while the larva of *S. equinus* prefers the liver, lungs and pancreas.

Both these forms ultimately return to the large intestine by piercing the gut wall.

The frequence and habitat of these three species vary somewhat. *S. equinus* is not an infrequent parasite in the right ventral colon but always occurs in small numbers. *S. edentatus* is a common parasite in the same habitat—always in large numbers and causing great damage to the mucosa. *S. vulgaris* is very frequently present in large numbers in the cæcum.

The third of the common genera, Trichonema, includes so many species, mostly very minute, that information regarding its biology is very meagre. In the few examples studied, the free-living infective larvæ shewed the same high resistance to adverse conditions. Their development inside the horse is still unsettled. Innumerable larvæ are found encysted below or within the mucosa of the large intestine—the exact site seems to depend on the size of the larvæ more than anything else.

Many of the adults of the genus feed actively on the mucosa, including three of the commonest species in this country—*T. coronatum*, *T. goldi* and *T. longibur-atum*—while others apparently feed on the vegetable matter of the intestine or on the small Probsymaria worms so frequently found there.

Hookworms are found in man, dog, fox, cat, pig and ruminants. The dog forms, *Dochmoides stenocephala* and *Ancylostoma caninum*, have a life-cycle very similar to those in man. The infective larva is capable of piercing the skin, and infection is normally caused by this method. The larva passes through the blood stream to the lungs and hence to the small intestine, where it develops into the bloodsucking adult. It is a source of considerable weakness and anæmia in dogs—especially in dogs which are kept in numbers in the same place, such as packs of hounds.

In sheep, a similar form—*Monodontus trigonocephalus*—is very commonly found in this country, at least 90 per cent. of the adult sheep being infected. Its life history is on similar lines, but it does not appear to be capable of passing through the skin, and infection is caused by swallowing the infective larva.

The stomach worm of sheep—*Haemonchus contortus*—is a serious pest in some parts of the world. Its anatomy and life history are fortunately fairly well known now-a-days. The eggs passed in the droppings quickly hatch, moult and become infective within about ten days. The infective larvæ are fairly

resistant to drying owing to their property of returning to moist positions when conditions are adverse. They can live in this way for about a year. When conditions are suitable, e.g., moist, dull weather, they climb up stems of grass and are eaten by sheep or cattle and develop directly, after moulting, in the abomasum into adults. The adults, which are vicious blood-suckers, are capable of laying eggs in about a fortnight to three weeks after infection, i.e., the complete life history takes, under favourable conditions, about a month.

Many other worms closely related to this form are found in sheep, the most important being *Nematodirus filicollis*, a very small threadworm occurring in enormous numbers in the small intestine of lambs in this country. They also appear to be blood-suckers, but in most cases appear to cause little harm. Their life-cycle is somewhat similar, but the egg takes much longer to hatch and the resultant larva is already infective. The remainder of the life-cycle seems to be direct. The larvæ shew an extremely high degree of resistance to cold and drying.

Ostertagia ostertagi and *O. circumcinata* are fairly common parasites of the fourth stomach, the former occurring in cattle and the latter in sheep. They are blood-suckers which appear to have a direct development similar to the stomach worm, although this has not yet been fully worked out. Once swallowed, they encyst beneath the epithelium of the stomach, coming to live free in the lumen when mature. A large variety of other closely related worms are also found in ruminants in this country, the commonest being *Cooperia curticei*, but nothing is yet known about their pathogenicity or their biology.

In pigs a closely related worm (*Hyostrongylus rubidus*) is frequently found, and it has been associated on several occasions with a fatal gastritis. Goodey has worked out part of its life-cycle, which seems to follow the general plan.

In horses, *Trichostrongylus axei* is found, a form also occurring in sheep and cattle, which is the cause of small plaques on the stomach which, however, seem to cause little or no trouble. Its life history is unknown.

The genus Habronema occurs in all parts of the world, and three species are found in the *stomach* of the horse. One species *H. megastoma* produces tumours which may reach the size of a hen's egg, while the other two (*H. muscae* and *H. microstoma*) cause a chronic form of gastritis. Moreover, their larvæ are the cause of "Summer sores"—sores which persist as indolent ulcers on the lower portions of the body during summer, but tend to disappear in winter. Only one species has so far been recorded from Britain (*H. microstoma*) twice as adults and once as larvæ in Cambridgeshire. They all have a similar life-cycle differing only in details. The eggs pass out with the fæces and are eaten by fly maggots which are feeding there. The first two species develop normally in the common house fly (*Musca domestica*) while the last species (although it can develop in the same fly) is normally found in the stable fly (*Stomoxys calcitrans*). The egg hatches in the maggot and passes to the adult fly. There when infective the larva takes up its abode in the proboscis. When the fly feeds on a moist, warm substance, the larva escapes. If this is the horse's lip it reaches the stomach and develops; if it is an open sore it lives for a time and causes the "Summer sore," but never reaches maturity. In the case of *H. microstoma*, although developing in a biting fly, the mode of infection is the same, as the presence of the larvæ prevent the stable fly biting, and so it has to seek its nourishment from sources such as the house fly.

This genus is a most important equine parasite abroad, but it does not appear to be common in Britain. Its peculiar development in manure-breeding flies indicates that its suppression may be undertaken by manure and fly control.

Anthelmintics.—Anthelmintics are, at least to a certain degree, selective in their action; thus ascarids and tapeworms in dogs are not both expelled by the same drug. Hence the choice of a drug depends on a fairly exact knowledge of the parasite present, and a diagnosis of "worms" is of very little help. The mode of administering the drug is also important and depends to a certain extent on the habitat of the worm (stomach, duodenum, cæcum and so on) and on the habit of the worm (whether it is attached to the mucous membrane and so on). Ascarids live free in the lumen of the small intestine, hookworms are attached to the mucous membrane for long periods at a time, whipworms have a large part of their body embedded in the mucosa, and so on. In general, also, drugs dissolved in alcohol are unsuitable for use against intestinal forms, unless it is desired that the active principle should be absorbed and so reach the blood-stream. Consequently, the medium used as a vehicle must be carefully considered. Olive oil, for example, has been found by Hall to increase the solubility and consequently toxicity of chenopodium for dogs, whereas castor oil distributes the drug throughout the intestine much more quickly, is much less toxic, and much more efficient. Male fern has been found by the same worker to be much more dangerous to dogs without castor oil than with it—probably because efficient purgation is essential if absorption is to be avoided. In general, too, if a purge is necessary, no period of delay is required in order to give the anthelmintic time to act. In fact, absorption much more easily takes place in the absence of purgation. A most important principle is that adequate starvation is essential if good results are to be obtained. A full stomach dilutes the drug unnecessarily, and moreover absorption is especially active when the stomach is full. Partly digested food in the intestine prevents the drug reaching the worms in a sufficiently concentrated condition to be effective. The starvation of the parasites has nothing whatever to do with the question, which is one rather of mechanical protection of the worm by the food, increased hyperæmia of the digestive tract with the consequent absorption and undue dilution of the active principle of the drug.

The passage of worms after treatment of course does not indicate that *all* the worms have been removed. It is an indication for the continuance rather than the stoppage of the treatment. Another principle of importance in the use of the anthelmintics is that the more severe the infection the more caution must be observed in the administration of the anthelmintic. Severe helminthiasis implies lower resistance on the part of the host and a greater susceptibility to the drug. *All* anthelmintics are poisons, and small repeated doses are indicated in such circumstances.

The drugs used against parasitic worms are legion; but the brilliant work of Hall in America has given a new value to most of them. A few and only a few are really of value against parasites. This work has revealed anthelmintic properties of a very high order in some new drugs—and Hall has conferred an incalculable benefit on humanity by his discovery of the use of carbon tetrachloride in hookworm infections in man. The more important anthelmintics in the pharmacopœia of the veterinary surgeon are carbon bisulphide, carbon tetrachloride, copper sulphate, arecoline hydrobromide, oil of chenopodium and male fern.

Carbon bisulphide has been found to have an almost 100 per cent. efficiency for bots and ascarids in horses. It is of value only for parasites of the stomach and small intestine; and is valueless for such worms as sclerostomes or pinworms. It should be administered in capsules, the dose being 6 fl. drams. If desired, the drug may be administered in two doses of 4 drams each at a two hourly interval or three doses of 3 drams each at an hourly interval. The repeated dosage is no more efficient than the single dose, but it gives an opportunity of suspending treatment should the drug seem to have bad effects. A purge should *not* be given, at least within several hours of the carbon bisulphide.

Carbon tetrachloride is one of the most important of modern discoveries in anthelmintic treatment. The drug has a selective action on blood-sucking nematodes —especially the bursate nematodes. Hall finds that it removes practically all the adult sclerostomes in horses, most of the ascarids in dogs, pigs, and horses, most of the hookworms in dogs and ruminants, and most of the stomach and other thread-worms in sheep. It has a remarkably high factor of safety for carnivores, provided it is not inhaled and is chemically pure. It has a rather smaller factor for herbivores and a fairly low one for pigs. It is useless against tapeworms, but its value against fluke is unknown. It has a definite effect on the liver, and experiments on its action in this connection will be of value.

Tetrachlorethylene, a drug closely related to carbon tetrachloride, has recently been found by Hall and Shillinger to have for dogs an efficacy at least equal to the older drug. It has a more pleasant taste and a smaller dose may be possible; but it is rather more expensive. Hall believes that the efficacy of the chlorine derivatives of the hydrocarbons depends to a great extent on the amount of chlorine present. The subject requires further elucidation, however, although it promises most attractive results.

Copper sulphate, which has an emetic effect on dogs, is without this action on ruminants, and in a 1 per cent. solution is a most useful drug against stomach worm and, to a lesser degree, tapeworm. It is easily administered in measured doses, either alone or in conjunction sodium arsenite or nicotine sulphate.

Arecoline hydrobromide is not a new drug, but it is only within the last few years that it has been used extensively for the removal of tapeworms in dogs. It is quite dependable, fairly safe, and requires no purgative. It is essential that the patient should be starved for at least 24 hours—36 is better. The dose varies from $\frac{1}{16}$ grain for dogs of 5-10 lbs. weight to $\frac{1}{2}$ grain for dogs of 30 lbs. and over. The average terrier will receive $\frac{1}{4}$ grain. It is best given in aqueous solution, by mouth, of course. It has no anthelmintic value if given hypodermically, and is useless against round worms.

Oil of chenopodium has been found to be one of the most efficient ascaricides known for dogs and pigs, and is a better drug for this purpose in these animals than carbon tetrachloride. It is extremely efficient against the sclerostomes and pinworms of the horse. It should be given in capsules after 24 to 36 hours fasting. It has, however, a distinctly constipating effect, and castor oil (for dogs and pigs) or linseed oil (for horses) should be given with it or about the same time. Liquid paraffin or olive oil are distinctly contra-indicated with this drug, as they afford no protection against absorption. For the same reason the fluid extract should not be used.

Male fern has long been known as one of the most efficient drugs against tapeworm; but recent work abroad and by Montgomerie in this country has demonstrated its value against liver fluke. It is most important to use a good sample of the drug, as many inferior preparations are on the market. Castor oil seems to hinder absorption in this case also, and should be used with the male fern against tapeworm.

Prevention.—The prevention of veterinary helminthiasis differs in many details from that of man, although the general principles are the same in both cases. One important difference is that of manure disposal. Hookworm disease in man has drawn public attention to the necessity for a proper disposal of fæces, and much has been done in the control of the disease by attention to this factor. Practically all of the important helminthic infections in our animals are due in the first instance to the distribution of eggs and larvæ in the fæces. The fact that, in addition, they feed on pastures and on the ground, explains why parasites are so prevalent in the domestic animals. If we could control manure disposal we could control the parasitic diseases. Animals are, however, continually depositing fæcal material on pasture land—a factor at present entirely out of our control. If, however, we cannot otherwise dispose of the manure, we can dispose of the permanent pasture, either by ploughing it up (an expensive process) or by changing the animal rotation on it. In addition to the dropping of fæces while at grass, much manure is collected from stables and cow-sheds and used for fertilising the land. It is possible—but the necessary data has not yet been

collected—that by physical or chemical methods manure may be rendered free from parasitic eggs without reducing its manurial properties. In the meantime we must adopt stock rotation of our three groups of mammals—horses, ruminants, pigs—the parasites of which are not interchangeable. And we can control our dogs and keep them free from tapeworms and consequently the stock (and man) from hydatid, gid and the other cystic diseases transmitted from the dog. Apart from these measures, the only other practical application of our present knowledge is to render the manure as far as possible free from eggs before it leaves the body—in other words by the use of anthelmintics. It is important to recognise that the use of anthelmintics is more of a preventive measure than anything else. The dosing of a single dog for Tapeworms, for example, while only curing one dog of a not very serious and often unnoticed disease, may prevent the death of innumerable other animals. From the point of view of the dog, all the tapeworms need not be removed in order to make any symptoms disappear. But all must be removed in order to avoid the infection of the intermediate host. This renders doubly important the principle referred to under anthelmintics. If worms are passed, it is an indication to continue, not stop, treatment. Moreover, it is the young animal which always suffers most from a helminthic infection, and it is only by keeping the adult free from parasites that we can hope to prevent their appearance in the young.

Accordingly the first principles of prevention are: Remove as many parasites as possible from the adults, and avoid as much as possible the use of permanent pastures. The permanent pasture is especially dangerous for the stock breeder, and particularly if it is rich and he is tempted to practise intensive feeding on it with its consequent overcrowding.

It is impossible to discuss in detail the measures to be adopted for all parasitic infections in animals. For this reason only three of the most important roundworm diseases in stock in Britain will be considered. The principles referred to in these and above can, however, be applied to other diseases and circumstances as necessary.

Stomach worms of sheep, and to a lesser degree of calves, are already a very serious hindrance to stock breeders in many parts of Britain. Treatment has been very successfully carried out by means of copper sulphate and sodium arsenite. The life-cycle in this case is direct, i.e., there is no intermediate host to bother about, and infection can only be caused by the animal swallowing the infective larva with its food. Unfortunately the larva can become infective within a week of the egg passing into the droppings, can live for a year in the grass, and is endowed by nature with the means of surviving adverse conditions. It is too difficult to get rid of to make attack in that direction possible. Accordingly we must adopt one of two plans. The first of these consists of pasture rotation. Horses or pigs may with safety be fed on the infected land, but ruminants must be kept off for at least a year. This plan means that sheep must be removed very frequently from pasture to pasture and presupposes the existence of a large tract of free land. An alternative scheme has been adopted with excellent results. The study of the life-cycle has shewn that after infection about a month elapses before the worm is laying eggs. The effectiveness of the therapeutic measures against this disease enable the animal to be dosed at monthly intervals with the knowledge that all—or nearly all—the worms in the stomach will be killed. In the meantime the sheep is kept on the infected land and is continually swallowing infective larvæ. These are killed by the monthly dose before they can lay eggs. No new larvæ can develop, and if the procedure is continued for about a year all the free larvæ have been swallowed (and in due course killed) or else they have died.

In this, as in the other diseases, the young animal is most susceptible and suffers most from the parasite, and consequently our first aim must be to protect the lamb. It we can tide him over this most critical period, we have not only a considerable saving in life, but an increase in the size and vigour of the animal. Accordingly, even if we cannot adopt either of the above plans, we must provide for the lamb the safest pasture available. The drier and higher the field, the safer the pasture, and the tendency to concentrate the young animals on the rich, low-lying pastures must be avoided. A system of rotation on temporary pastures also decreases the risk of infection; while in extreme cases it will be necessary to avoid permanent pastures entirely during the breeding season.

Sclerostomes in horses.—In the absence of much necessary information on the life histories of these forms, our measures for protection are necessarily greatly restricted. We do know, however, that in many—probably all—cases the development is direct, that infection is by swallowing the larvæ, and that these larvæ are extremely resistant to drying and variations in temperature. Feeding on hay, for example, is useless as a protective measure unless one can be sure that the hay has never been in contact with horse manure. For the present, we must concentrate on the protection of the young horse which suffers much more than does the adult. The mother can be effectively freed from these worms by the use of Oil of chenopodium or Carbon tetrachloride, and once free she may be placed on temporary pastures which have not been used for horses at all. During that period she must not be allowed to feed outside of the temporary pasture and must not be given hay—although oats and bran are permissible. Ultimately both mother and foal will contract the infection, but with care this event may be postponed sufficiently long to avoid the more serious effects. It is impossible at the present stage to keep the horse permanently free from sclerostomes. In the adult, however, most damage is done by the very large numbers normally present, and these can be kept under control to a certain extent by the systematic use of anthelmintics.

Ascarids in pigs are among the most serious parasites from which these animals can suffer, and here again it is the young animal which is most seriously affected.

Infection in this case is caused by swallowing the very resistant eggs, which are present in millions in the ordinary sty. The young animal is stunted permenently in growth, becomes more susceptible to other diseases and generally is a "piner." A system following much the same lines as those suggested under the sclerostomes has been adopted with great success in America. The sow before farrowing is carefully cleaned (special attention being paid to the udders) with soap and water and is placed in a thoroughly disinfected pen. Really hot water and a carbolic disinfectant are essential and all litter must be burned. The pen must not communicate in any way with the other sties in the yard. The sow and her litter are kept here for about ten days and then removed in a crate to a pasture on which pigs have not previously been kept. The young pigs are kept there until they are about 100lbs. in weight, when they may be returned to the sty. During their stay in the field, they must have no contact whatever with the older infected pigs. Modifications of this system may be necessary for special cases. Where no fields are available for example, the young animals may be kept in the cleaned farrowing pen, but the manure must be daily removed and frequent disinfections take place. We have in oil of chenopodium a safe and very effective drug against this parasite, and the sow may be dosed early in pregnancy and kept in a clean pen until near farrowing time, when she is removed to the specially prepared sty. We have no drug which will prevent the larvæ passing through the lungs ; and this is the state of affairs which we are most anxious to avoid. Prevention and absolute cleanliness will save millions of pounds to the pig-breeding industry.

These three diseases are probably the most serious helminthic infections of stock in Britain. There are others nearly as serious, however, but space does not permit of a discussion of the various means of prophylaxis which might be adopted. Unfortunately, too, there are many gaps in our knowledge of the biology of these parasites, and our armoury will not be complete until these are filled. It is only by the continual work of the helminthologist in the laboratory and the practical application of his results by the veterinary surgeon that we shall be able to fill these gaps., In this respect, helminthology differs, for example, from such subjects as veterinary pathology. The scientific work must be done by a zoologist who need not also be a veterinary surgeon. That this is the case is shewn by the fact that many of the important discoveries in the biology and morphology of the helminths of domestic animals have been made by men who were not interested in the pathology of the disease. It is of interest to note that this principle underlies the organisation of the Institute of Agricultural Parasitology (in the London School of Hygiene and Tropical Medicine), which is under the direction of Professor R. T. Leiper, an honorary member of this Association, and which is staffed by graduates in pure science, medicine, veterinary medicine, and agriculture. This combination permits of a breadth of view-point which could not otherwise be obtained and enables all the various sides of the question to be considered adequately. The aim of the Institute is to provide the necessary data, the application of which must always remain in the hands of the veterinary surgeon. The scientist may be compared to the munition worker in the fight against the parasites of the domestic animals ; the practitioners are the first-line troops who alone can gain the victory.

Discussion.

Mr. A. W. Noel Pillers, in opening the discussion, said : I wish to thank the Provisional Committee for placing the opening of the discussion of Dr. Cameron's paper in my hands and I trust that what I have to say may be the means of initiating an instructive and interesting debate. The essayist is to be congratulated on having placed before us a number of recent advances in helminthology whch have important bearings on our usefulness to owners of animals. In a paper which deals with isolated facts concerning trematodes, cestodes and nematodes, it is to be expected that many of us would have liked to have seen something which has not been included. Whilst interest in parasitic diseases is stimulated by reference to annual loss in stock, I think the veterinarian of a few years standing is more likely to take the subject up seriously when it is pointed out that the handling of these diseases in an up-to-date manner is a paying proposition. There is no doubt that the diagnosis, treatment and prevention of helminthiasis at the present time forms no small portion of the veterinarian's activities, and with care his sphere of usefulness in this direction can be considerably increased. The progress which has been made in helminthology since it was discussed at Carnarvon in 1910 and at the International Veterinary Congress in London in 1914, is very striking. It is my view that the subject—perhaps linked with protozoology and arthropodology, as parasitology—should now form a definite syllabus in the educational programme of the Royal College of Veterinary Surgeons. It should not lengthen the course and need not be an exhaustive one, but a type in each group should be studied in detail, and especial attention paid to the detection of ova or other diagnostic bodies of pathogenic species in the tissues and discharges. The clinical, therapeutic and preventive aspects of parasitic diseases would be more fully appreciated if placed in such a syllabus, instead of perhaps being almost lost in that conglomeration known as veterinary medicine. Perhaps the first step in this direction will have to be the publication of a text book on the lines I have indicated.

Dr. Cameron's heading of diagnosis refers to the determination of the species or group of worms present and not to the clinical condition ; this is an important distinction to which I shall refer presently. The simple method of detecting ova in the fæces, if done in every case, would represent a considerable advance, when compared with a diagnosis of worms, made over a hedge ; or from a history of eating excessively and going thin, but from a considerable experience I cannot agree with Dr. Cameron that for most practical purposes it is sufficient for the practitioner. Sieving, and one of the floatation methods are, to my mind, esssential, and especially is this so with equine fæces. One has to try to assist in the diagnosis of a

diseased condition. The veterinary surgeon is not as a rule called in to treat the mere presence of worms, save perhaps in the dog and cat, but has to deal with ailing animals. It is here that the difficulty arises. Many unthrifty and visibly sick animals have eggs of pathogenic helminths in the fæces, and certain worms are apparently only harmful when present in sufficient numbers. The question to be settled is whether or not the condition is due to worms. It is the difference alluded to above, viz., *worm infection* as distinct from *worm disease*. Fortunately for the host, but unfortunately for the clinician, an infection does not always turn into disease. A diagnosis of worm disease should only be made when all other causes have been ruled out, and when the finding of eggs of a pathogenic species or species is backed up by a typical history and clinical picture. The case is more simple when one has a dead animal from an ailing group. Whilst a microscopic examination therefore aids diagnosis, it cannot displace the practitioner. I have had many experiences bearing on this truth. In goats suffering from Johnê's disease one may find large numbers of *Eimiria*, and eggs of *Trichostrongylus sp.* and *Haemonchus contortus* in the fæces. Obscure cases of debility and unthriftiness in colts may show considerable numbers of eggs of *Strongylus* and *Trichonema* (*Cylicostomum*) in the dung and yet make a rapid recovery when treated by a sound clinician, who backs his opinion against the microscope, by treating them for a deficiency condition associated with thyroid disturbance.

I can imagine no greater disaster than for a young practitioner to rely on finding fluke eggs in the fæces to tell him what to do with a bunch of stirks, sheep, goats or pigs. Perhaps in time we may hope for improved diagnostic methods or some standardisation of egg counts on the lines of Stoll's method. Help can sometimes be gained by making a simple blood smear and staining it by Leishman's method in order to show the percentage of eosinophile cells present. Burnett (*Clinical Pathology of the Blood of Domesticated Animals*, Macmillan, London, 1917) gives the normal eosinophilia for the horse as from .5 to 5.8 per cent., and in the case of sclerostomiasis from 7.1 to 13.3 per cent. This is a very useful little work and should be of value to many practitioners. Changing nomenclature is disturbing to us all, but it is necessary with progress and already we are in a clearer atmosphere. The parasitologist is not alone in this matter, for one finds the veterinary anatomist of one school using the complete modern nomenclature whilst others are still employing the old and isolated veterinary names.

It is surprising how rarely one comes across a dog harbouring adult *Taenia echinococcus*, when the hydatid is so common in cattle, sheep, pigs and horses; possibly a wild carnivore may be concerned in its spread. I have obtained *Cysticercus cellulosæ* from a pig of Irish origin. It appears to me that Dr. Cameron's description of the external lesions and results of *Oxyuris equi* applies rather to the exception than the rule, nevertheless it is a parasite whose presence should not be neglected.

With regard to the life history of *Strongylus*, are we to understand that every larval *S. vulgaris* stops or is arrested at the ilio-cæco colic artery (or others)? It may be found in the bowel without visible arterial lesions; the worms in the aneurism may be so large as to make one doubt the possibility of their return to the bowel; and finally the vessel lesions do not appear to be proportional to the gut infestation. Thrombo-embolic colic is more prevalent than clinical reports would suggest. To my mind, it is one of the common colics of the horse in this country and merits a fuller consideration than the few lines given to it on page 44 of the 3rd edition of H. Caulton Reek's work. Apart from clinical cases, I have seen many *post-mortem* examinations where abrupt terminations to extensive hæmorrhagic lengths of bowel have been explained as "twists which have come undone." Careful examination has proved that a large number of such cases are of thrombo-embolic origin. The cranial mesenteric artery supplies most of the small intestine, the cæcum and the colons; *S. vulgaris* lesions are prevalent; and disturbances in movement of the bowel, and fermentation must arise as a result of circulatory derangement. It is, therefore, not surprising that some writers have blamed it for causing so high a percentage of "colic." *S. edentatus* in the cryptorchid testis is common and if the normally placid organ contains it to the same extent, some interesting speculations arise.

In view of the active migration of larval nematodes through the body, I do not think sufficient attention is paid to the question of pre-natal infection. It is perhaps recognised in some systems of prevention, but in brood sows, bitches and mares, many intestinal nematodes are of added importance owing to the chances of the unborn becoming infected at the same time as the dam. One need not, therefore, be surprised at lesions or worms in the newly born.

Is a gelding passing large numbers of "red worms" in its fæces, sound? Or what is the position of the veterinary surgeon when examining such an animal or one just up from grass?

Dr. Cameron, in that portion of his paper dealing with anthelmintics, is careful not to mention treatment because here again arises the question of worm versus disease. *Worm expulsion* is quite distinct from *cure of worm disease*. Although removal of the cause is a first essential, the veterinarian is not often called in until there are extensive lesions, both local and remote. Exceptions occur perhaps with a few "doggy" clients; or when a domestic pet gets entangled in yards of tapeworm, or there is an unsightly egg-mass under a horse's tail, or ascarids are found in manure on the carriage way. I join with Dr. Cameron in praising the work of Hall and his colleagues with regard to anthelmintics. He has also given prominence to the experiments of earlier workers. His little book ("Diagnosis and Treatment of Internal Parasites," M. C. Hall, *Veterinary Medicine*, Chicago, 1923) should be of great use to many practitioners.

In the main, my experience with carbon bisulphide, carbon tetrachloride, copper sulphate, arecoline hydrobromide and male fern agrees with Dr. Cameron's. Care and attention to detail are essential, and fasting is often very important. With carbon bisulphide and tetrachloride in capsules for horses it is advisible to rasp the teeth if the hand is going to be used for balling, but as these drugs are so dangerous in the mouth I think it is better to use the stomach tube, a little

water being allowed to run down immediately afterwards in order to prevent any being brought up on the end of the tube. I hardly know what to say with regard to oil of chenopodium. Hall's work was done with old horses weighing about 1,100 lbs. each. They received 16 mils. (4.5 to 5.6 ƒ3) in or followed immediately by a large dose of linseed oil. In this country, at least, under conditions of practice, with young animals, of different weights and reduced vitality, a much lower dose is necessary. Yet it must be remembered that with half doses the efficiency is greatly reduced. I take it that you will all agree with me when I say that it is better from the point of view of the practitioner to fail to cure a hundred horses than to kill one. I have heard of several unsatisfactory cases in horses and dogs and now that carbon tetrachloride is giving such satisfactory results I think there is nothing to be gained by running risks. Further, it is not always easy to exclude all the conditions, *viz.*, fever, heart disease, gastro-intestinal irritation and kidney conditions, in which the administration of oil of chenopodium is contra-indicated.

Although turpentine is only mentioned once in the table, it has done a deal of useful work in equine sclerostomiasis. I am convinced that it has a practical percentage of efficiency.

That worms may be expelled and yet the patient die of the effects of them has already been hinted at in alluding to the distinction between worm expulsion and cure of worm disease. In addition, therefore, the clinician has to resort to an extensive array of other measures which vary according to the parasite, the host and the number of them. They include hygiene, dietetics, and therapeutics. One has only to mention anæmia and debility ; the uphill fight of a severe " red worm " case, after the worms have been expelled, is well-known to most of us ; the damaged gut wall, the digestive disturbances, the debility and the changes in the blood call for much care and further treatment.

I agree with Dr. Cameron that so long as our patients defæcate, as it were, on their dinner plates we shall have serious parasitic diseases with which to deal. Here, undoubtedly, we may apply the American slogan which I attribute to Hall, *Permanent pastures perpetuate parasites.* Some day we may see crops grown, cut and fed to some species of stock from mangers on " bare lots." It pays for many crops now, and the labour involved may be balanced by there being no damage to the growing crop by feet, pulling, and dung droppings.

A useful degree of control can sometimes be obtained by dosing all the animals, resting the land as long as possible and then reducing the stock. Overcrowding on the same land, without rests, is responsible for much disease.

The rotation of horses, ruminants and swine is not often possible on farms with which the average veterinary surgeon has to deal, owing to the grazing habits of each group and the proportional numbers of each, which are kept.

I wonder if Dr. Cameron can give us actual *data* concerning the application of the McClean County system, which he describes under ascariasis of swine. The Americans claim that it makes pig breeding possible, where it was previously unprofitable, and further that it " pays big dividends." I have recommended it on several occasions, but some practitioners are bad correspondents. Dr. Cameron's account of the Institute of Agricultural Parasitology, and reference to the *Journal of Helminthology*, prompts me to mention the considerable assistance which the veterinary profession in the North have received for many years from the professional staff of the Liverpool School of Tropical Medicine and its journal, *The Annals of Tropical Medicine and Parasitology.* Doubtless in other areas other institutions have also helped the cause of veterinary helminthology.

As Dr. Cameron's table is on the last page of our proceedings, it is quite likely that it will find its way, supported by four pieces of stamp paper, to the inside of the glass door of the small drug cupboard. I think, therefore, that with regard to oil of chenopodium for horses the maximum and minimum doses should be stated for every 100 lbs. from about 900 lbs. upwards, to be followed immediately by as large a dose of linseed oil as possible. Perhaps something similar is necessary, *viz.*, dose according to weight for this drug, in swine. Possibly some of the mistakes which have happened would have been avoided if, in all cases, anthelmintic dosages were stated at so much per kilo live weight with minimum and maximum dose weights. Even then a lot of us are not so good at estimating the weights of our patients as we think we are. I trust other speakers will bring out points that I have missed for want of time ; the treatment of the respiratory helminthiases is such an one.

Colonel H. G. Bowes (Headingley, Leeds), said he would like to express his great appreciation of the paper written by Dr. Cameron, and also to congratulate the Provisional Committee on having secured Mr. Pillers to open the discussion. No one, in his opinion, was more capable in the profession. There was one aspect which particularly interested him, *viz.*, parasitic gastritis affecting sheep and particularly lambs. In the Craven District of Yorkshire they had a disease which had been known for many generations as " Drying " in lambs, an alternative name being " double scaup " (i.e., double scalp), a name gained by the appearance of a double scalp due to the thickening of the frontal bone. The first practice of the farmers in dealing with the disease was to crack this double scalp.

Some years ago, the speaker said, he had had an opportunity of making a number of *post-mortem* examinations of a number of cases of this disease, and as a result formed the conclusion that this disease was simply due to a heavy infection with the different varieties of strongyle worms. Contrary to what was generally indicated in the text books, he found that the *Strongylus contortus* was not a common one present, which was the reason it had been so long unknown. He did not know what the other varieties were, but they were small hair-like worms, mostly less than half-an-inch in length—so small, in fact, as to escape notice in most *post-mortem* examinations where they were present. Microscopical examination revealed large numbers of parasites present, and the disease, which caused wasting, generally occurred in the district he had in mind, in lambs about three months old and upwards. Many died of the disease, but he thought that the greatest losses were due to the wasting and loss of condition of the animals affected. One point of interest was the question of the infection of the lambs. The grazing of the sheep was

not on low-lying land at all, but up in the hills, and it was there that the lambs were most seriously infected, contrary to what would be expected.

Another question that interested him was, how long land would remain infected. In some districts it would be possible, perhaps, to change the grazing, but not so in the Craven district, which was solely grazing land, and therefore change would be impracticable. In any case, if it were practicable, in his opinion the larvæ would live for years. He had, indeed, found live larvæ in lamb-droppings kept in tubes for considerably over two years. He had found the copper sulphate treatment to be the most effective in combating the disease in his district, but he recommended them, in dosing lambs or sheep for the worms, to treat the whole flock in monthly doses during the three months of July, August and September, using a 1 per cent. solution of copper sulphate. This he had found to be absolutely effective in getting rid of the disease.

Another point he wished to mention was the increasing prevalence of parasitic bronchitis in pigs, and he said that his experience in the last two years had been that this condition, *i.e.*, infection of the lungs with *Strongylus paradoxis*, had increased both in numbers of cases and in severity. He mentioned this because in his view there could be little doubt that the cause of this was the increasing custom of feeding pigs out of doors. He did not suggest this as an argument against out-door feeding, but he thought it one of the factors making two diseases more prevalent, *viz.*, swine erysipelas and parasitic bronchitis. When pigs were kept in sties the buildings might be regularly cleaned and disinfected, but not so the land.

In conclusion, he would like to ask if any other practitioners had any other experiences similar to his own.

Mr. R. BARRON (Blandford), said he would like to confirm the views expressed by Colonel Bowes. In Dorset, they had great losses in lambs due to parasites, and it was the *Strongylus cervicornis* which was the main cause of the trouble. Some farms were so badly attacked that they could hardly keep sheep at all. Now, however, the problem of prevention had been solved by the farmers dosing their flocks regularly with arsenical pills, the lambs being dosed from one month old upwards.

Mr. Barron said he also agreed with Colonel Bowes about the increasing prevalence of parasitic bronchitis in pigs, and thought that the animals took the ascarids from dirty sties. The habit of keeping about fifty sows all round the buildings on a large farm, led to the ground becoming soiled, and as a preventive measure he advocated moving the sows on from time to time. The sow should be disinfected before farrowing, as it was presumed that infection was spread by way of the udder. These two diseases could be prevented if the right methods were tried.

Mr. HUGH BEGG (County Veterinary Inspector, Lanark), asked whether the two gentlemen could indicate some line of prophylaxis regarding the treatment of infected lambs. He mentioned the case of a Shetland pony which had come under his notice some years ago which died from debility and showed large swellings under the abdomen. On *post-mortem* examination he had found the bowels to be absolutely choked with worms. Could the previous speakers indicate any treatment to meet such a case?

Another type of case he wished to mention was where a cow showed signs of acute tuberculosis, with wasting, etc. One such case, which had been condemned, was examined *post-mortem* by him in the presence of the dealer, when he found that the bronchial tubes were simply filled with worms, and he asked if it was common to find that one manifestation.

Mr. G. P. MALE, of Reading, said that the subject under discussion was such a big one, that he hoped there would be more papers in future on parasitology. In his opinion, it was one of the most important subjects to the veterinary practitioner. He acknowledged his gratitude to Dr. Cameron for preparing the paper, and in regard to Mr. Noel Piller's suggestion that a text-book should be written on the subject, he would like to suggest that none were more qualified to prepare such a book than the two gentlemen named. If they had not time to write such a book he would suggest that they prepare a parasitic dictionary for the benefit of the busy practitioner who had no time to follow the changes in nomenclature from day to day.

He thought that many cases of colic were due to these parasites. He himself had had a case two or three months earlier, when a valuable thoroughbred mare, which had been to a stud, showed signs of acute pain, accompanied by sweating, the passing of a quantity of blood, blowing, a rise in temperature and a bad pulse. On exploring the rectum he examined his arm and found hundreds of minute parasites adhering to it. He immediately realised that this was a case where the parasites were leaving the bowel in very large numbers. Fortunately he had some saline tablets with him, which he induced the mare to take dissolved in a large quantity of water. She took a bucketful of water every two or three hours for nearly two days. In addition, he gave her an injection of saline solution, and he was glad to say that she made a good recovery. Mr. Male asked what were the chances of a foal in such a case being infected *in utero*. Perhaps such infection would account for the many deaths in foals.

He was also very interested in the respiratory helminths. In thoroughbred foals he had had enormous numbers infected with ascarids. When they were about six to twelve months old almost invariably they were infected with what was commonly called "dirty noses." Was that a separate infection or was it due to these embryos travelling through the lungs and up the bronchial tubes to cause the respiratory trouble? He had recently made a *post-mortem* examination of one such foal, and had found it infected with ascarids, besides having pneumonia.

With regard to pigs, as Mr. Begg had said, bronchitis due to ascarids was very common, and there again, he would like to ask if the lung symptoms were due to these embryos travelling through the lungs—which they undoubtedly did—and up the bronchial tubes, or was it due to the *Strongylus paradoxis*? In large numbers of *post-mortem* examinations he had made on pigs which had had constant trouble with lung symptoms he had found a few strongyles in the bronchial tubes, but a very large number of ascarids in the bowels. He would like to know whether the lung symptoms were due to the *Strongylus paradoxis* or to the ascarids.

One point he would like to ask the essayist, *viz.*, did he recommend dressing the land with salt or lime in the prevention of the disease?

Professor CRAIG added a note of appreciation to Dr. Cameron for his paper and to the speakers who had taken up the discussion. There were a few points in the paper he would like to touch upon, the first of which dealt with the life history of ascarids. His mind had been engaged for some years on this subject.

His audience had no doubt observed that in cases ten-twelve weeks old there was no previous history and no respiratory distress. This he had confirmed by careful observations. He had found in puppies of that age that the worms were all about the same age and about the same size, which meant that the infection with those worms occurred at about the same time, indicating further that the larvæ must have passed through the lungs at about the same time. One would have expected to have had severe respiratory distress. He had come to the conclusion, from the evidence he had collected, that pre-natal infection did occur, and, that being so, he thought it not sufficient to rid the bitch or the sow of infection at one period only of pregnancy but at several periods.

Another matter which he said he would hardly dare to mention but for the fact that it was brought up by Mr. Pillers, was that of the tape worm. Dr. Cameron had said that the tape worm of the dog was well-known, and he felt that most people would agree with that statement, and yet he wondered if the life-histories of these tape worms, as they knew them, represented the whole truth.

With regard to the disinfection of buildings, he said the suggestion of using carbolic was new to him, and in view of the fact that one could incubate the eggs in a 5 per cent. solution of carbolic, he thought it could not be effective. What he did suggest was that faith should be pinned to mechanical disinfection with warm water, soap, soda and the scrubbing brush, and getting rid of the eggs down the drain. He had been very interested in what Mr. Pillers had said regarding the part played by worms in so-called " worm disease," and he himself was beginning to wonder whether in this condition the worms did not play a secondary part. Generous feeding, was, in his opinion a great preventive.

Mr. JAS. MARTIN, SENR. (Wellington), said that he lived in a district teeming with parasitic infection, and as diagnostic aids in connection with doubtful cases of " red worm," he used chlorodyne and turpentine, which soon indicated whether there was infection or not.

In connection with losses (on high farms) that pertained to " red worm," he pointed out that there were always pits there, and in his opinion these pits were the sources of infection. In such cases he had always had the pits dug over and had kept sheep off the land for several months.

He had always had cases of the infection in February. There was one high farm of which he knew where they drenched all the ewes for several years. One season they omitted to drench two rams, and the next year the only animals infected were these rams. All the ewes were clear of infection.

A MEMBER said that a condition which he had recognised for thirty years, and one which should be given more prominence, was that in which the ewes at lambing time died of fatty liver and kidney trouble. This condition of fatty liver was ascribed to concentrated feeding before lambing, but that was not the case on his farms, and yet the deaths occurred, with livers pale and fatty and kidneys in like condition. His conclusion was that in many cases the condition was due to auto-intoxication from parasitic gastritis in the fourth stomach, and he thought that death occurrred owing to the strain of lambing at a time of lowered vitality.

Mr. E. BRAYLEY REYNOLDS (Newmarket), in referring to the case of the mare mentioned by Mr. Male, had some interesting facts to mention regarding the precautions taken against infection of the foal in the well-managed stud he had in mind. He said that no expense was spared to keep the animals free from parasites. A paddock was reserved solely for the weaning of the foal, and no other animal was ever allowed to enter that particular paddock. All droppings were picked up and carried away and every means known were adopted to keep the paddock clean. In spite of these precautions, cases of parasitic infection still occurred. One case was a two-year-old, and another a three-year-old, but these were the only two animals apparently affected out of ten or fifteen. These two animals wasted considerably, and on *post-mortem* examination the cæcum and large intestine were found to be swarming with all sorts of strongyles. He thought that the other animals must have been equally infected, and yet they showed no evidence, and he thought it surprising that, where such great care was taken to guard against infection, cases should still occur. In connection with this, he would mention that although prophylaxis, in the cases quoted, was carried out perfectly as far as it was known, yet he thought there was much more to learn in the nature of prophylaxis. Investigations in that direction, he thought, would do much to lessen the mortality amongst horses.

He was in agreement with Mr. Male that no future Congress should be held without a paper being read on Parasitology, and he put forward the suggestion to the " powers that be " that there should be a tendency to divide the Congress into sections, one of which should be devoted to Parasitology.

Mr. H. C. I. KELLY (Portadown), said that the subject under discussion was most important and that there were certain points, especially affecting liver flukes in cattle, on which he would be glad of a little information.

Dr. Cameron had described a simple method of finding the eggs, but he would like to ask if these could be found at any time of the year or only at a certain season. Was it in the early Spring that eggs of the liver fluke could be found in the fæces ?

He went on to say that he had been advised that a saturated solution of sugar brought out the eggs and, later, that this solution actually destroyed them. If that was so, would sugar fed direct to the animal destroy the eggs in the bowel? Another important point in which he was interested was the diagnosis of the liver fluke. In his opinion it was one of the most difficult diseases to diagnose because the symptoms were so very varied. If he were asked what were the symptoms of liver fluke he said he would say " anything."

In view of the recognised intradermal test for tuberculosis and a proposed similar test for abortion, he wondered whether it might not be possible to discover any test for the condition of liver fluke.

Regarding the dressing of the land against parasitic infection, Mr. Kelly asked if animals could be put to grass immediately after this was done, or should there be a considerable waiting period ?

Professor R. T. LEIPER (Director of the London School of Hygiene and Tropical Medicine), acknowledged with thanks the invitation that he should say a few words to the meeting. He said that there had been very great advances in the past fifteen years in the subject of helminthology, and there had been even greater discussions. In their discussion that morning, which had been opened and sustained entirely by veterinarians, he had noticed a very significant thing, *viz.*, that many of those who were clinical workers were interested in the subject, equally with the technical workers.

In his opinion it would be a bad thing to break the activities of the Congresses in future into several sections. So many points had been raised for Dr. Cameron that he would not add to the number, but there were a few things he would like to say.

With regard to the fox, this animal, he said, was a wild carrier, and appeared to play a very significant—if not a most important—part in spreading infection.

Another point he would comment upon was Professor Craig's remarks regarding tape worms in dogs. He thought it possible that his diagnosis might not be quite accurate. Recently, in London, they had had considerable numbers of cysts from London mice sent to them. These were fed to dogs and produced tape worms in them. With regard to Public Health technique, he would like to suggest to Mr. Noel Pillers that the smear method was quite sufficient for the identification of infection. Concerning the carrier, he was of opinion that the time would come when healthy animals would be treated as well as those actually sick. This was illustrated by his experience in connection with liver fluke in Ireland. The question of using copper sulphate was one which had arisen in the laboratory and he went over to preach its adoption and to carry out experiments. As a result he had come to the conclusion that the method was useless, as the bowels spread infection, and he regarded it now as quite impracticable. What he did suggest, as a more promising line, would be to treat the infected stock (not the sick stock, but those animals which had survived) during the dry months, although healthy. The treatment should be given at that time because then there would be few flukes and the grass would not be infected.

The speaker concluded by once again thanking the Association for allowing him to attend and listen to a most interesting discussion.

DR CAMERON'S REPLY.

Dr. CAMERON said, in reply, that he wished to follow the custom of most speakers in rendering thanks, firstly for the opportunity he had had of writing the paper, and secondly for the Provisional Committee's choice in asking Mr. Pillers to open the discussion.

Before entering into the body of his reply, he wished to draw attention to a printer's error in his paper, where, on p. 180 in the 10th line, the word " not " had been slipped in, altering the meaning entirely.

The first point with which he wished to deal was the dressing of land in the prevention of parasites, and he said it was difficult to say at this stage whether they could adequately dress land with any chemical compound which would not destroy the manure value. In the case of ascarids he thought it was quite impossible, and the use of salt as a dressing he thought had no value whatever, at any rate as far as ascarids were concerned. The strongyle larvæ mentioned by Mr. Begg might possibly be destroyed by salt, as he had found in laboratory cultures that one of the most difficult conditions in which to raise larvæ of strongyles was a very slight solution of saline. Perhaps, therefore, a heavy dressing with salt might be of use against strongyles. However, in view of the very long time that larvæ could live under adverse conditions—especially some of those of worms of the sheep —he thought that it would be difficult to eradicate the trouble by dressing the soil.

With regard to lung worms, he thought it was only in the young animals that the disease was serious. In his opinion, the question of pre-natal infection was of enormous importance, and he observed that pre-natal infection of ascarids in all animals was an established fact, as was also the case with some of the lung strongyles, although there was no definite evidence of the latter in the case of the horse.

He thought the question of the disinfection of buildings was an important one, but he did not agree with Professor Craig in thinking that carbolic acid was not effective, as his experience was that the only effective disinfectant was carbolic acid. He had not much faith in mechanical means of disinfection, because of the way ascarids adhered to smooth surfaces and of the difficulty of getting rid of them by mechanical means. In his opinion, perhaps, the most effective one was soda combined with elbow grease.

With regard to liver fluke infection, this might be encountered at any time of the year, though, on the other hand, it was only at a certain definite season that it would cause trouble. The animal with the few flukes would be required to be looked to. He thought that double infections in animals were the rule rather than the exception, particularly in the sheep and in the horse and, with regard to the latter, he believed it to be almost impossible to have a pure infection. In any case, the animal which was debilitated by a parasite such as the liver fluke was soon attacked by others.

In conclusion, Dr. Cameron dealt with the question of pellets, and said that, though he held no brief for Cooper's, he would say that though powder was the most convenient method of administration for the trained veterinary surgeon, the pellet was the best way for a less efficient practitioner. The saline method was perhaps the most efficient.

A dispute over the value of a pedigree cow, which was certified by the Westmorland County Veterinary Surgeon as suffering from tuberculosis and was destroyed, is to be referred to the Ministry of Health for arbitration. The compensation was fixed by the valuation offer at £25, but the owner put its value at £100.

The Veterinary Record.
24th October, 1925.

VETERINARY HELMINTHOLOGY.

This week we have the pleasure of presenting to our readers the extremely interesting paper on Veterinary Helminthology, prepared by Dr. CAMERON for the Congress at Cambridge, together with an account of the discussion to which it gave rise.

Dr. CAMERON earned the thanks of the members of the Association by placing before them in concise form the latest available *data* connected with a number of subjects of importance in every-day practice.

There is no doubt that the subject of Helminthology is of great importance to the veterinarian, and the keen discussion which took place showed clearly that this importance is well appreciated by many of our members.

Dr. CAMERON laid emphasis on the severe losses which are caused annually by parasitic disease, and we consider that, in his able and very practical opening speech, Mr. NOEL PILLERS did well to remind members that in the application of modern methods to the diagnosis and treatment of such diseases, the practitioner is able to render valuable services to his clients, very naturally with material benefit to himself.

It is probable that the majority of members will agree with the view put forward by Mr. MALE, and endorsed by other speakers, that at future congresses a place should be found for further papers on helminthological subjects.

Several speakers referred to the fact that some of our most serious parasitic diseases appear to be increasing, and it was pointed out by Mr. PILLERS that the conditions under which the domestic animals are commonly kept must tend, in the absence of special preventive measures, to favour further infection.

In view of the undoubted, and probably increasing importance of parasitic diseases in practice, many of our readers will probably feel that the opinion advanced by Mr. PILLERS, that it is desirable that Parasitology should form a separate subject in the ordinary curriculum for the diploma of the R.C.V.S., deserves careful consideration.

There would appear to be no doubt at all that we need a new text-book on Veterinary Helminthology, for at present there is no book, in English, which we can regard as reasonably up-to-date.

The writing of a text-book, however, is a serious undertaking, which would necessarily occupy a considerable period of time, and pending the appearance of such a work, one of our helminthologists might well, we think, act on the suggestion of Mr. MALE, that the practitioner needs a dictionary to enable him to keep in touch, or rather to *regain* touch, with modern helminthological work.

Help of this nature might well take the form of a paper published in one of our journals. Such a paper, giving the outlines of modern classification, indicating the fate of such old friends as *Sclerostomum armatum*, and giving both the older and the newer names for the commoner parasites, might not be an important contribution to literature from the helminthologist's point of view, but it would earn the gratitude of very many who need and desire to know as much as possible of the subject without making a special study of it.

FOOT-AND-MOUTH DISEASE.

A fresh outbreak of foot-and-mouth disease was confirmed on Saturday on premises at Staplefield, near Haywards Heath, East Sussex. The total stock on the premises consisted of 41 cattle and 161 pigs, of which seven cattle and a number of pigs were found to be affected. There was, at the time of writing, no information as to the means by which disease was introduced to these premises, but inquiries are being made. The slaughter of the stock was proceeded with.

An order has been made imposing the usual restrictions on the movement of animals within a radius of about fifteen miles of the affected premises.

* * *

The Marquis of Lincolnshire, speaking at a luncheon at High Wycombe Agricultural Show at Little Marlow last week, referred to an outbreak of foot-and-mouth disease on one of his farms in the district. He desired to pay a high tribute to the Ministry of Agriculture for the way in which they tackled this serious problem. Within twenty-four hours of the outbreak the whole of the stock on the small holding farm had been destroyed and measures taken to prevent the disease spreading. The public responded nobly to the conditions laid down. The result of the prompt measures taken by the Ministry was that there was no further outbreak, which he thought a "record."

* * *

SERIOUS OUTBREAK IN NORTH MIDLANDS.

"The existence of foot-and-mouth disease was," says *The Times* of October 21st, "confirmed late on Monday on premises at Hazel Grove, Stockport, Cheshire, three out of a lot of seven cattle being found affected. There had been no recent movements except of pigs, large numbers of which are received by owners for the purpose of killing. The majority of these are drawn from Manchester, the last batch being received on the 17th inst. Inquiries are proceeding both in the Stockport and Manchester districts as to the origin of the disease.

"Late on the same day suspected disease was reported from the abattoirs at Rotherham, and yesterday morning the Ministry's inspector confirmed the existence of disease in the carcass of a cow there. This animal was one of six which had been purchased in Doncaster market on the 13th inst., and sent by rail to Rotherham on the same date.

"In view of the serious possibilities in the situation, restrictions have been imposed over a large area covering a radius of fifteen miles from Hazel Grove, Doncaster, and Rotherham."

REVIEW.

Official History of the Army Veterinary Services in the Great War.

(Reviewed by MAJOR-GENERAL SIR FREDERICK SMITH, K.C.M.G., C.B., F.R.C.V.S.).

Fourth Notice.

GALLIPOLI.

The veterinary account of the war in Gallipoli is not narrated by the responsible officer, who had retired from the Service before this history was written. Nevertheless, we learn much of this terrible and costly civilian blunder.

We are told of the preliminary difficulties and delays which so admirably helped the enemy; of the first and subsequent landings, and of the months of never-ending shell and rifle fire. We can see the Veterinary Hospital huddled up against the cliffs for protection, its personnel in dug-outs, only venturing out during a lull in the bombardment mercifully to destroy some mangled patient. We are told of the intense heat and dust of summer; of the bitter cold of winter; of the difficulties of supply, for even water had at first to be carried to the peninsula. The difficulties in attending the sick, even when active operations were not occurring, were considerable, for any movement drew fire; the patients had to walk to water at 100 yards interval for fear of raising a column of dust, and the hospital had to work at night and early morning.

The difficulties of disposing of manure are described, in default of which it became a breeding ground for flies, followed by dysentery among the men. The early attempts to dispose of the dead by throwing them into the sea only resulted in their persistent return to shore: the next attempt to tow them out to sea, owing to their hoofs sticking up in the water, led to their being mistaken for enemy periscopes, and they had finally to be sunk.

The sick were evacuated to Egypt (800 miles away) or to the island of Mudros (60 miles distant), where base veterinary hospitals and convalescent depôts existed. No ship could stand in close to the shore, so the animals were taken out in lighters and slung on board: again slung overboard into lighters at Mudros, and so ashore. Some thousands of animals were dealt with by this slow and laborious process.

Finally, we come to the difficulties of the retreat in the dark, while the pretence of holding the front line was carried out to deceive the enemy. During these operations the weather at sea was unfavourable; lighters containing mules were sunk or lost, and finally the stores, tents, forage, equipment of all kinds were set on fire and the remaining sick in the veterinary hospital destroyed. Nothing was saved but what the men stood up in, though, through the initiative of Captain H. C. Stewart, the six chests of hospital equipment were fortunately got safely away as the last boats pushed off in the dead of night from the blazing shore.

Appended to the report are statistical tables of sickness and inefficiency week by week. They must be read with care in conjunction with the text at page 117, and appear to us to need further explanation. There were roughly 3,400 horses and 5,400 mules in the peninsula, but the tables appear to cover the thousands of animals strung out on the long line of communication extending from the Ægean Sea to Egypt. Half of the admissions were from injuries, including gunshot; one quarter from disorders of the digestive system due mainly to sand taken up with the food; and one-tenth to debility.

Abundant experiences was obtained in battle injuries, and the casualties of the Indian Transport Corps, a unit specially exposed, are quoted. In four months they had 858 animals killed or wounded at Anzac, and at Cape Hellas they lost fifty animals a month from the same cause.

The Royal Naval Division formed part of the force, and had their own transport. True to the traditions of the Naval Service being self-contained, they produced two veterinary officers, one from the Royal Naval Reserve and one from the Royal Marines! Another officer of Marines, an ex-veterinary student, was also employed on veterinary duties.

We are glad to draw a veil across this heart-breaking record, which as long as history lasts will remain a permanent memorial of ignorant and vicious diplomacy.

EGYPT AND PALESTINE.

Chapter xi., from the pen of Colonel Todd, deals with the operations in Egypt and Palestine in 1914-18; the subject is adequately presented in 150 pages. Having given a useful account of the physical features and climate, he takes up his subject in historial sequence, grouping it by years; this leads to a little overlapping which is unavoidable.

The war was at first mainly static, later it became a war of mobility. Colonel Todd has illustrated each phase by a sufficient reference to the military conditions to render the story intelligible and interesting. Let all who have lost faith in the value of mounted troops in war study these pages with attention. In them they will learn what horses are capable of doing against a well organised and determined enemy, under conditions of intense hardship and exposure.

Passing over the successful operations against the Senussi on the Western Front, we come to an account of the operations in the Sinai peninsula. We here obtain definite chemical information as to the amount of salt in water which renders it undrinkable by animals. If water contains eight parts per thousand it is not rejected, a few will drink it if containing nine parts per thousand, but practically none where the salt amounts to ten parts.

The growth and development of the Camel Corps is a subject to which considerable attention is naturally paid. Beginning in a small way, it grew into an enormous force, there being a Corps of 4,000 camels

for fighting purposes attached to every Division, quite apart from its other animals. The Camel Transport was still larger; in six months the number of animals so employed rose from 10,000 to 50,000. Constant purchases had to be made to keep up the strength, and we are glad to see the veterinary officers mentioned by name who were charged with this laborious and thankless work in unhealthy districts. It is gratifying to note that ultimately the Veterinary Service undertook the entire responsibility for the purchase and supply of camels. The supply, however, could not be maintained if the same rigid veterinary exclusion was followed as in the past. All credit therefore, to the man, Major-General Butler, who had the courage and confidence in his service to recommend the purchase of camels slightly affected with mange or sore backs. This is the only example on record of deliberately sinning against one of the cardinal rules of experience, by purchasing for use in war animals knowingly affected with contagious disease. We are told of the special methods adopted in dealing with these purchases and the results completely justified the risks taken.

The employment of such large numbers of camels necessitated the provision of remount depôts, hospitals, and convalescent depôts for their use, and in the Field a special evacuating organisation for returning the sick to the base. A treatise on the Management of the Camel was published as a guide to the thousands of men who were to be closely associated with an animal they had previously never seen. The great success ultimately obtained was due to the training of all ranks by competent officers, and the use of the above-mentioned handbook in which camel requirements were clearly laid down. In this connection, the help given by the two civil branches of veterinary administration in Egypt can never be forgotten.

Among the events recorded in 1916 are desert marches, long and weary patrols, artillery traction across sand, the precautions taken to spare animals as much as possible during active operations, the adverse conditions affecting them, and finally the gallant conduct of the men of the Mobile Veterinary Section of the 5th Mounted Brigade, who bore the brunt of an attack on the defences, and whose conduct was specially referred to by the General Officer Commanding. A summary of this period is given at page 166, and is supplemented by an account of the losses. Every feature of animal management is brought under review, whether of horses, mules, or camels; their water, food, forage-substitutes, clipping, shoeing, saddlery, disposal of the dead, camp sanitation, shipping arrangements, diseases, and statistics of wear and tear. During the rest periods the lessons which had been learned led to improvements in animal management, including the creation of a school for the training of young officers.

The year 1917 saw active arrangements in progress for the projected Palestine campaign. We are told of the advance on Ghaza, of the great benefit to the animals of the green crops then met with, especially its effect in clearing the intestines of sand with which every horse and mule was more or less affected. The disastrous battle of Ghaza with its losses is mentioned. It is instructive to note that this action was fought during the hot weather, and though 335 camels succumbed to heat apoplexy, no equine was affected. The latter half of the year 1917 was occupied in increasing the water supply in preparation for another attack on Ghaza, in improving the transport arrangements, and by long cavalry reconnaissances not only testing these arrangements, but rendering the force familiar with the country which lay before them. In October the advance occurred, and we are informed of the immense distances covered by the mounted troops in the attack on Beersheba and Ghaza, and of the length of time the animals were without water. There is a full description of the method of veterinary evacuation, including the formation of Field Veterinary Posts which were used as reception centres for animals brought in by mobile veterinary sections, so enabling the latter to rejoin their Divisions without delay. A careful study of these arrangements at pages 202 and 211 is recommended to all officers. The charges made by mounted troops against entrenched positions, and the resulting losses among animals, are fully recorded, and are invaluable statistically, being precise figures for this unusual class of warfare.

These operations were carried out under intense heat, scarcity of water, and on 9½ lbs. of grain per horse, with practically no bulky fodder: it must also be remembered that the horses were carrying 21 stone. In such terrible work the grain ration was absurd, but let the civilian critic realise what even this small ration meant in the way of transport. It required that 100 tons of grain should be supplied daily for cavalry horses alone, to say nothing of food and forage for the men and animals of the Army generally. At this time the Army was miles in advance of rail head, so that everything had to go by road, a single narrow sandy track with not a bridge left, nor a well fit for use. A particularly valuable table is given at page 208, of the length of time the various corps and divisions were without water and the amount of food received by the animals during these operations. No such table on such a large scale has previously existed.

After a few days' rest the advance on Jerusalem began, the weather now changed to one of incessant rain, biting cold winds, the ground a bottomless viscid black mud over which camels could not move. The forage supply was not only precarious, but there was an immense loss of grain through its getting wet and fermenting. The men without coats or blankets had to face the tempest.

The losses during these two months of heavy fighting amounted to 10,000 casualties among the horses, mules and donkeys,* of which 5,000 were killed, died, or were missing. The average animal strength for the last half year of 1917 was 82,500

* Nearly 13,000 donkeys were purchased in Egypt between September and December, 1917, and were formed into Transport Companies of 200 in each. They did splendid service in the hills of Judæa.

equines and 48,200 camels; during this period the equine wastage was 8 per cent., and that of the camels 13 per cent. A full grouping of the losses according to diseases and injuries is given. It is gratifying to learn that in the Special Order of the day, published by the Commander-in-Chief on reaching Jerusalem, the Veterinary Service was commended for its work.

Space does not admit of adequate consideration of the final operations of the war in 1918, resulting in the annihilation of the Turkish Army. As in previous operations, all veterinary arrangements had been carefully worked out, and detailed instructions issued to all concerned. This was only rendered possible by the Director of Veterinary Services being informed of the Commander-in-Chief's strategical scheme. Veterinary Staff Duties had at last come into due recognition.

Step by step we are taken through the operations of 1918. With the occupation of the Jordan Valley malaria among the men and surra among the camels had to be feared. The Turks in this vicinity had lost 42,000 camels from this cause in three years. The heat of the valley in summer is dreadful to contemplate, 130 degrees in the shade being recorded. In time of peace the valley is never occupied in the summer, but it was necessary for the troops to hold it. By September arrangements for the final advance were completed, the troops now consisted of the Desert Mounted Corps of Australians and New Zealanders, now on horses; Indian Cavalry, together with two Army Corps. The animals numbered 74,800 horses, 39,100 mules, 11,000 donkeys and 35,000 camels.

To the Desert Mounted Corps was allotted a task the success of which was vital to the whole campaign, and special instructions for the working of their mobile sections were issued. The hospital accommodation at the base was increased in anticipation of heavy demands on it, and material brought to the front for erecting temporary paddocks for the reception of large numbers of animals pending their evacuation to the base. Finally, there was a careful allocation of Field Veterinary Detachments, not only on the line of communication but those projected in forward areas, based on a personal reconnaissance made by the Director of Veterinary Services.

In five phases the operations are described which terminated in the obliteration of the Turkish forces and the occupation of Aleppo in October. The war was over!

Not a word of this account of one of the most complete victories ever gained by the British Army should be missed: a summary is given at page 242. Then follows an outline of the process of clearing up, including the disposal of the diseased animals of the enemy, among which were 270 cases of glanders.

The statistics of losses are of the utmost importance in view of the prominent part played by the mounted troops. There were 27,000 horses belonging to the cavalry; of these 4,000 were killed, died, or were destroyed, or missing, and 5,000 were sent to hospital. The Divisional and Transport losses are also given.

The whole constitutes a fine story, and if in the future mounted troops disappear from our army, their last operations in a war of mobility can be looked back on with pride and satisfaction.

The contagious diseases affecting all animals in Egypt next come under review, also an account of the special precautions taken to limit the spread of surra. It is noteworthy that 500 cases of anthrax occurred between 1917-20. Coccidiosis occurred in 1917 among slaughter sheep, and 5 per cent. died.

We have no space left to deal with the question of veterinary hospitals; they had to be expanded to receive 2,000 and occasionally 3,000 patients. The arrangements of the hospitals, material used in construction and general system is fully described and plans furnished. There is a special chapter on Camels and Camel Hospitals by Major Rabagliati, O.B.E., who is an expert on the subject. His services were lent to the Army by the Egyptian Government, and his contributions to this history are distinctive and valuable.

During the whole period of the war in Egypt and Palestine, the Veterinary Service treated 447,760 horses, mules and donkeys, and 266,000 camels. Of these numbers 32 per cent. of the equines and 25 per cent. of the camels were hospital cases. The total losses from all causes during the war was 46,600 equines and 32,000 camels.

This hasty and imperfect notice of an epoch-making chapter is regretted, but perhaps we have said sufficient to induce others to read it for themselves. General Butler and his officers added to the best traditions of our service; he is fortunate to have had in Colonel Todd so admirable an historian. We regret that it is impossible to do more than mention the excellent veterinary officers of the Antipodes, whose enthusiasm was as unbounded as their patriotism. Nor can this notice close without again referring to the Directors of the Veterinary Services of the Civil Government, Messrs. Littlewood and Branch, who helped the Army both by the loan of their staffs and by contributing their own wide professional experience in every possible way.

Milk and Dairies' Act Appointments.

At a meeting of the Annual Committee of the convention of Royal Burghs, held at Edinburgh, on October 14th, objection was raised to the proviso under the Milk and Dairies Act for the appointment of whole-time veterinary inspectors in burghs. The Board of Health, Sir Henry Keith, the Chairman, said, had issued a circular to Authorities and others stating that it was essential that these inspectors should be whole-time officers. That meant a considerable addition to the public health assessment of every burgh. The question was whether it was necessary.

Both in letters of protest and in discussion it was pointed out that burghs combining in the matter would not do any good, and that the proviso should not be obligatory. Every case should be considered on its merits.

Mr. Thomson, Town Clerk, Ayr, said that the Act was to ensure good clean milk, and they should not regard it from a too narrow point of view.

A committee was appointed to discuss the matter with the Scottish Board of Health.

ABSTRACT.

(A Comparison of the Immunity to the Intradermal and Subcutaneous Anti-anthrax Vaccination in Cattle).

It has been observed that there is a marked difference in the susceptibility of laboratory animals and the larger animals to infection by *B. anthracis.* Whilst guinea-pigs and rabbits are extremely susceptible to infection by inoculation, they will not contract the disease by way of the mouth. Moreover, as shown by Besredka, if care is taken to avoid a contamination of the skin, these animals will resist all methods of infection. Cattle, horses and sheep, on the other hand, are susceptible to all the channels of infection. Sheep and horses readily succumb to a subcutaneous inoculation of the second pasteurian vaccine, whilst the ox, although more refractory, is easily infected by way of the mouth.

Besredka has also demonstrated that the intradermal vaccination of the guinea-pig protects the animal against all attempts at infection. The purely local immunity which is produced confers, in reality, an immunity which is absolute. The serum of such vaccinated guinea-pigs has no protective properties and the resistance to infection does not lie in the presence of specific antibodies. In the larger animals, on the other hand, the protection which results from vaccination and from sero-vaccination or following recovery from a natural infection is due to the presence of antibodies which confer a general immunity. The experiments of Brocq-Rousseau and Urbain in the horse, of Vallée in the ox, of Mazucchi in cattle and sheep and of Velu in the sheep have shown that these animals are readily susceptible to a cuti-infection and that a solid immunity results from a cuti-vaccination.

Twelve heifers were used in the experiments of Sachelarie. Five were vaccinated by the intradermal inoculation into the subcaudal fold of the first and second pasteurian vaccines. A dose of 0.25 c.c. was given on each occasion with an interval of eight to ten days. Four were vaccinated subcutaneously in the usual manner and three kept as controls. As a result of the intradermal inoculation, a slightly painful œdematous swelling was produced at the point of inoculation but there was no marked elevation of temperature. No reaction was observed in the heifers vaccinated by the subcutaneous method.

After a period of four weeks, experiments were carried out as follows :—

(*a*) Two heifers vaccinated intradermally, two vaccinated subcutaneously and two controls, were inoculated intradermally with 0.25 c.c. of a broth culture. In the controls a hot, painful swelling was produced at the point of inoculation and persisted for several days. The temperature rose to 41.5°C. after the twenty-fourth hour and remained high for three to four days. Recovery slowly occurred, leaving the animals in poor condition. The two heifers vaccinated subcutaneously gave a slight reaction. The temperature rose to 39.5°C. during the two first days and a hot, painful swelling was produced at the point of inoculation. The animals vaccinated intradermally showed no reaction.

(*b*) One heifer vaccinated intradermally and one subcutaneously received 0.5 c.c. each of culture intradermally. The former gave no local reaction nor any rise in temperature. In the latter, a swelling was noted at the point of inoculation and the temperature rose to 40°C. on the second day.

(*c*) A sporulated culture mixed with roughened glass was fed to a beast vaccinated by each method and one control after scarifiction of the buccal mucous membrane. The control died of anthrax at the third day. The two vaccinated animals remained healthy and showed no rise in temperature.

(*d*) One heifer vaccinated intradermally was fed with an entire agar culture mixed with glass. After forty-eight hours, there was a marked rise in temperature and great prostration, but recovery occurred. The author considers that the symptoms were of such a gravity that without the protection afforded by the vaccination, recovery could not have ensued.

It was shown that the sera of all the vaccinated animals were capable of protecting guinea-pigs against a mortal dose of culture.

The author concludes that the intradermal vaccination against anthrax affords a remarkable resistance against natural infection.

(V. Sachelarie. Etude comparative sur l'immunité conferée par la vaccination anticharbonneuse pratiquée par inoculation dans la peau et par la vaccination pasteurienne classique, chey les bovius. *Rev. Gén. de Méd. Vét.*, 1925, May, Vol. 34, No. 401, p. 229-240).

R. E. G.

Richardson Memorial Lecture.

The next Benjamin Ward Richardson Memorial Lecture, in connection with the Model Abattoir Society, of which he was the founder, will be given by Dr. W. J. Howarth, C.B.E., Medical Officer of Health, City of London, at the rooms of the Royal Society of Medicine, 1 Wimpole Street, Cavendish Square, W., on Friday, November 20th, at 5-30 p.m. The subject of the lecture will be : "The Slaughtering of Animals for Human Consumption—Observations on Methods practised and desirability of Centralisation in Relation to Meat Hygiene."

Royal College of Veterinary Surgeons.

Obituary.

Frew, Gordon McCrae, Tureen Street, Glasgow, Graduated Glasgow, July 24th, 1883. Died at Glasgow, 11th October, 1925.

The Destruction of Dogs and Cats.

By Capt. H. Kirk, M.R.C.V.S.,
Wigmore Street, W.

For many months our professional journals have been carrying on intensive discussions concerning the humane slaughtering of animals, but little thought appears to have been bestowed upon the small domestic pets. Yet the dog is credited with an almost human understanding and is undoubtedly far more susceptible to sorrow, fear, pain and general harsh treatment at the hands of his worshipped master, than any of the food animals or beasts of burden.

A large proportion of the dog-owning public is, however, aware that there are several methods of destroying a small animal, some of which may not be so swift and painlesss as might be desired. It may not be out of place to review all the methods of destruction which are now available, indicating under each heading the attendant advantages or disadvantages.

1. *Shooting.*—This method, when properly performed, is certainly painless and one of the most rapid, but it can never be universally adopted by the practitioner on account of (*a*) the danger to others of a ricochet, (*b*) the probability of movement of the animal at the critical moment, (*c*) the noise, and (*d*) the alarm and repugnance aroused in the owner, should that person be present.

2. *Prussic Acid Poisoning.*—Death from prussic acid is probably not painless, but it is so very rapid and certain that it commends itself to me as a desirable method of destruction. Its practical utility is undoubted, and its performance necessitates the least possible restraint and handling; consequently it gives rise to the least alarm in the patient. A dog or cat need only sit upon a table, or even upon one's lap, when suddenly a hypodermic needle is thrust between the ribs and in less than thirty seconds all is over. The poison may, if preferred, be administered by the mouth (to cats with the aid of a fountain pen filler), the animal then being immediately enclosed in a basket or other receptacle. For destruction of a cat, Scheele's acid (containing 4 per cent. hydrogen cyanide) is employed, 1 c.c. swallowed proving fatal in something under two minutes; ½ dram would end life within thirty seconds. If injected into the pleural cavity, 1c.c. would be fatal in about ten seconds. Dropped into the conjunctival sac it is quickly lethal.

In general practice it is wise to give an ample dose, for cases have been known in which dogs and cats, having been supposedly poisoned, have been disposed of by placing their carcass on a manure heap. After some time, such animals have been known to resume unexpectedly their normal place in the household, as the manure heap supplied just those essentials (stimulants and warmth) which were needed to aid recovery. The first effect of a toxic dose is to stimulate the respiratory and circulatory organs, which effect is rapidly followed by depression and violent muscular contractions. The respiratory muscles then become paralysed, the animal gasps for breath, and is eventually asphyxiated. Before actual death it is contorted by tetano-clonic convulsions, shrieks out, vomits, and often urinates and defæcates. The heart beats stop several seconds after the respirations. On the other hand, when a very large dose has been given, the cerebro-spinal axis is paralysed, and death follows almost instantaneously from cardiac arrest. It is a moot point, therefore, as to whether the shrieks emitted in the death throes of prussic acid poisoning are the effect of great pain, or arise merely as a result of muscular contraction, as do also the bodily contortions so constantly witnessed. Such shrieks may, however, be reduced to a mere whine if the mouth be held closed.

3. *Lethal Chamber.*—Although held in much esteem by many people as a humane killing instrument, I hold that the lethal chamber, unless properly used, may be more terrorising to the dog or cat than some other methods. One can only judge of the effect upon the nervous system, by imagining the feelings one would personally experience by being thrust into a closed and often dark box from which there was no escape, and in which the air was charged with a strange and nauseous vapour. Dogs and cats *do* sometimes struggle frantically to regain their freedom, as they seem to have an intuition of impending evil.

Such struggling may endure any time from three to ten minutes before drowsiness overtakes them, rendering them physically immobile if not quite mentally inert. The length of time occupied in killing them will depend upon the nature of the chemical used, its strength, the air-tightness of the box, and the constitution and resistance of the animal. On the other hand, if the chamber is properly constructed, the vapour very gradually applied, and the operator experienced, this method of destruction may be classed among the most humane.

4. *Morphia or Chloral Poisoning.*—For dogs, probably the most humane and least alarming process of all is the hypodermic injection of an overdose of morphine. It should, however, be remembered that dogs can withstand immense doses of morphia without fatal results, for Hobday's experiments proved that, in at least one case, even twenty grs. failed to kill an aged dog. For an ordinary terrier a dose less than three or four grs. would probably fail to prove lethal.

Cats cannot conveniently be destroyed by morphia on account of the delirium it produces in them, and hyoscine is equally useless; but chloral hydrate can be substituted. In full medicinal doses chloral exerts a sedative action on the central nervous system, producing a natural and deep sleep, from which the animal awakes without discomfort. I gave an adult cat a warm rectal injection consisting of 1 dram of syrupus chloral with three drams of gum mucilage. Within half-an-hour the animal was quite drowsy and was soon in a stupid, relaxed condition, followed by apparent unconsciousness. This soporific state endured for twenty-four hours.

When a dog or cat has reached such a subconscious condition as a result of either morphia or chloral,

matters could be expedited by injecting prussic acid or administering chloroform. No method of destroying an animal is calculated to occasion less alarm and pain than the procedure just outlined, but its great drawback is the length of time required for its fulfilment.

One-and-a-half drams of syrup of chloral given per rectum to the cat mentioned above, caused its death in three hours; but during that time there had been exhibited a certain amount of nervous excitement and giddiness which would be undesirable in one's endeavour to produce euthanasia.

5. *Chloretone.*—This salt resembles chloral in many respects, and cats have an idiosyncrasy in regard to it. Poisoning very easily occurs in cats from the administration of an overdose and from experiments. I have found that anything over two grains is nearly always fatal. But here again arises the difficulty of time, for a cat may linger in oblivion from about five to twenty hours before expiring. Nevertheless, death is painless. (See *Veterinary Journal*, June, 1924.)

6. *Chloroform.*—When painless destruction of dogs and cats is under consideration, most people's thoughts revert to chloroform, and there is no doubt that death produced by its agency can truthfully be so described. Yet, to be precise, it must be realised that in its administration, a certain amount of restraint is necessary during which the animal struggles with what strength it has to free itself until overcome by the vapour. Moreover, many sturdy dogs (particularly, I find, the aged ones) occupy a quite considerable period before they are even anæsthetised, let alone destroyed. I have known cases in which I have had to pump in vapour for twenty minutes or more before the stage of anæsthesia was reached.

Conclusions.—In view of these various facts, it seems that the best method to adopt for destroying a dog, when the owner is scrupulous about the entire absence of terror and pain, is a preliminary injection of morphia (chloral for a cat) followed later by prussic acid or chloroform.

What is understood to be the first case arising under the Tuberculosis Order (1925) was heard at the Derby Police Court on Monday, October 19th, when Spencer Holton, cattle dealer, of Brockenhurst, New Forest, Hants., being summoned for failing to give information that three bovine animals were, or appeared to be, suffering from tuberculous emaciation.

Mr. H. H. Wallace, markets superintendent, said that the three beasts were obviously suffering from some disease, probably tubercular. They had been sent into the market by defendant to be sold by an agent. Notices were served under the order, and two of the beasts were slaughtered. A valuer was called in, and the value of the beasts was given as £3 10s. and £4. Defendant gave no notice to the effect that they were slaughtered. Mr. W. F. Aston, M.R.C.V.S., said that both slaughtered animals revealed traces of tuberculosis. A *post-mortem* examination on the third cow also revealed the disease. In addition to the risk of infecting other cows there was a grave risk of infection to human beings, as the udders were infected.

Defendant pleaded that the cows were not sold as dairy beasts, and he had not the least idea that they were tubercular. The Bench considered the case a very serious one, defendant being fined £5 and ordered to pay the veterinary surgeon's fee.

DIVISIONAL REPORT.

Midland Counties Division.

Meeting at Birmingham.

The quarterly meeting of the Midland Counties' Division was held at Birmingham, on Wednesday, September 9th, the first portion of the proceedings taking place at Holliday Street Wharf, and the remainder at the Grand Hotel. The President (Mr. T. Slipper, of Sutton Coldfield) occupied the chair, and there were also present Messrs. H. Tudor Hughes (Oswestry), W. H. Brooke (Handsworth), J. Cormack (Coventry), W. F. Aston (Derby), S. M. Woodward (Birmingham), J. W. Conchie (Kidderminster), J. W. Powley (Knaresborough), H. E. Powell (Coalville), T. H. Hobson (Leicester), A. J. Curtis (Shrewsbury), E. Beaumont (Bishop's Castle), H. B. Hiles (Worcester), F. E. Sower (Birmingham), G. V. Tyreman (Ludlow), J. Scott-Bowden (Colwall), T. Martin (Wellington), R. Lake (Ashby-de-la-Zouch), J. A. Canwell (Lichfield), J. Robertson (Stourbridge), H. L. Pemberton (Bridgnorth), J. Martin (Wellington), C. J. Clifford (Shifnal), R. C. Forrest (Alcester), T. N. Gold (Redditch), H. W. Griffiths (Birmingham), H. B. Allen (Birmingham), J. M. Whyte (Tenbury), W. E. Ison (Atherstone), C. F. Parsons (Cheltenham), W. T. Olver (Tamworth), J. G. Parr (Leicester), A. Renfrew, jun. (Broadway), W. L. Sheffield (Quorn), J. Scott (Leamington), J. Young (Birmingham), R. H. Over (Rugby), R. Murray (Rugeley), R. P. Holmes (Birmingham), Brennan DeVine (Birmingham), L. W. Heelis (Solihull), R. P. Palmer (Warwick), J. A. McLauchlan (Stourport), W. E. Blackwell (Towcester), W. Dale, jun. (Coventry), G. F. Banham (Stratford-on-Avon), H. S. Cockburn (Eastwood), H. Yeomans (Smethwick), H. W. Dawes (West Bromwich), J. Martin, jun. (Newport, Salop), J. C. Deville (Uttoxeter), Lieut.-Col. Marriott (Birmingham), and the Hon. Secretary (Mr. H. J. Dawes, West Bromwich).

The visitors included Professor J. Basil Buxton (Cambridge), Colonel Wilkes (Lahore, India), Messrs. H. S. Sumner (Liverpool), J. Robertson, jun. (Stourbridge), L. Jordan (West Bromwich), P. E. Bayliss (Birmingham), J. C. Naylor (Rugeley), W. J. Leyshon (Cambridge), H. M. Wilson (Edinburgh), G. Howe (Buxton), and G. E. Gibson (Newport Pagnell).

Apologies for absence were received from the following: Sir John McFadyean, Sir Gilbert Barling, Professor Penberthy, Major F. T. G. Hobday, Messrs. E. Ringer, W. Tart, J. J. Burchnall, L. C. Maguire, L. A. Auchterlonie, M. Tailby, T. Spencer, D. J. Anthony, R. L. Phillips, T. Chambers, H. A. Turner, R. McGregor, A. A. Forsyth, T. Ludlow, J. L. Gooch, F. T. Prince, M. Sadler, C. S. Hunting, J. A. R. Jones, C. Haywood, E. Brayley Reynolds, L. C. Tipper, G. H. Barber, H. S. Reynolds, R. Hughes, E. Hall, J. R. Carless, W. W. Gresby, D. Forwell, T. J. Brain, and J. Barker, and others.

The Intradermal Tuberculin Test.

The first matter claiming the attention of the company was the witnessing of a demonstration of the Intradermal Tuberculin Test by Professor J. Basil Buxton, who afterwards answered a number of questions.

Mr. Ison asked if this particular test would come within the scope of the Tuberculosis Order of this year.

Professor Buxton: No particular test is specified, but if the point arises, I would suggest that you ask the Ministry of Agriculture.

Mr. DeVine asked whether Professor Buxton would regard this as a good test for diagnosis under the Order. When that division visited the Ministry of Agriculture's laboratories at Weybridge last year, they saw what was known as the eye test, in which there was said to be a good reaction, but when it was tried at home they got an indifferent reaction. The injection was made in the lower eyelid, which was a sensitive part, and yet when he injected there, he did not get as good a reaction as when done on the side of the neck. Did Professor Buxton consider the reaction on the animals that day was good? He had tried this test, and he was bound to say he was not so convinced with the result as he would like to be from the report they had had. Would Professor Buxton give them his own candid opinion, as a guide to practitioners present, as to what was the best thing to do. He (the speaker) had been testing animals subcutaneously for twenty years, and he had never once known that test to fail. Could the same be said of the intradermal test? If they had a lot of animals to do, it must save time. After the subcutaneous test, a good many examinations were necessary.

Professor Buxton said he considered that this test was at least as good as any other. He did think honestly that it was a good test, and it would be difficult to come to any other conclusion in view of the test that was carried out at the Metropolitan Cattle Market. It was on 114 animals and in only three instances were anomalous results obtained. No other experiment had been done as completely as this one. It was said that any test that would give a standard of efficiency of 80 per cent. was a good one, but this experiment showed 97 per cent. of efficiency. He was not prepared to give an opinion on one eye-lid test, which was, no doubt, a very good one, and he only chose the neck because it was the most convenient place. If the same tuberculin was used, he could not see why there should be any difference in the result whether it was applied in the eyelid or on the side of the neck.

Mr. DeVine suggested that it might, on occasion, be difficult to apply this test, but although that might be true in some parts of Scotland, where the client lived fifty or a hundred miles away, it should be easy enough to the ordinary practitioner, who could go when he liked to take his readings or give his second injection.

Mr. Tudor Hughes said that when he was in America, he saw this test done by injection into the caudal fold. It had the advantage of being practically the only hairless portion of the cow's anatomy. He had tried the eyelid test and it was not as easy to do as in the case of the horse. The cow seemed to be more sensitive about the eyelid then the horse. Another point was the possibility of an animal inflicting a skin injury on itself with the chain, and the friction caused by the chain might even cause them to consider a reaction doubtful. Was the maximum number of visits required likely to be two or three? That might make a big difference to a busy practitioner.

Professor Buxton replied that he preferred the side of the neck as the seat of injection. With regard to chain injury, so far the test had been done on several hundreds of animals, and he had never heard it suggested that the chain had any harmful effect. It did not matter if the chain did chafe, because it would not change a non-reactor into an apparent reactor. As to the number of visits, in almost every instance, when one had tested a number of animals, three visits would be necessary, because there would be sure to be some about which the operation was doubtful. Forty per cent. or more would give a decent reaction to the first or sensitising dose, but, on the other hand, there were always some which appeared to be doubtful, so that a third visit was almost invariably necessary.

Mr. Hughes: Has the skin to be lathered, or is the hair shaved off dry?

Professor Buxton: If lathered first, the animal does not object so much, but it really does not matter. The shaving is done for the convenience of the operator, and he can do as much or as little as he likes. The animals you saw to-day were shaved more than is necessary merely for the purpose of demonstration.

The Hon. Secretary: The shaving was done to-day with a safety razor and without lather.

Mr. Whyte: What about the temperature?

Professor Buxton: The temperature is not taken; it is purely a local reaction.

Mr. J. Martin: What tuberculin was used for to-day's operation? Cambridge, or Pasteur, or R.V.C., or any special kind?

Professor Buxton: We always use our own tuberculin, which has been tested for potency first. It has to come up to a certain standard.

Mr. Martin: Is it on sale to the profession?

Professor Buxton: It has been on sale to the profession for a considerable time.

Mr. Parr thought they were between two stools. In the first place, they read a report of the Tuberculin Committee in which they advocated the intradermal test, and on the other hand, they had two of the highest authorities in the profession who rather tabooed it. As inspectors, they would like to know what the professor advised.

Professor Buxton: If the test is being carried out under the Certified Milk Orders for the Ministry of Health, this test is recognised by them. If it is being done for the Ministry of Agriculture under the Tuberculosis Order, it would be best to get the opinion

of that Ministry first, as to whether they will accept this test or not. But I would recommend every veterinary surgeon to try this test.

Mr. OVER: Is there any objection to carrying out the subcutaneous test as well?

Professor BUXTON: It might be used concurrently with this, but I think you would do well to confine yourself to one or the other.

Mr. MCLAUCHLAN: If we used the two tests, one would be a check upon the other.

Mr. DEVINE: At what stage would you use the subcutaneous test?

Professor BUXTON: When the sensitising dose is put in.

Mr. PALMER: Are there any comparative notes on the two tests?

Professor BUXTON: The percentage of efficiency from the subcutaneous test is well known. I believe Mr. DeVine has excellent figures to show the reliability of the subcutaneous test. The Americans are satisfied with an 80 per cent. efficiency, and in our one experiment with the intradermal test at the Metropolitan Cattle Market we got 97 per cent. of efficiency, and the *post-mortem* results have confirmed it.

Mr. PALMER: You have given this test a fair trial. Do you intend to give the subcutaneous test a similar trial in your own Institute?

Professor BUXTON: No; there would be no point in doing that.

Mr. FORREST: If an animal reacted under the intradermal test, and not under the subcutaneous test, would you consider it tuberculous?

Professor BUXTON: I should accept the intradermal result as conclusive.

Mr. DEVINE: Where do you draw the line between definite and indefinite reaction?

Professor BUXTON: So far, we have not had any indefinite reaction with the double intradermal test.

Mr. H. W. DAWES said that, whilst preserving an open mind on that matter, there was one question he would like to ask. Where an animal had reacted to the sensitising dose the reaction might be accepted at once, but in regard to those that gave a slight reaction only, was it not possible that the mere injection of a small quantity of tuberculin would, in some cases, produce of itself a slight increase in the thickness of the skin?

Professor BUXTON replied that undoubtedly, in the case of a non-tuberculous animal, when a second dose was put in there was some slight increase in the thickness of the fold, but it did not simulate a reaction.

VOTES OF THANKS.

The HON. SECRETARY said he would like to propose a vote of thanks to Professor Buxton for coming to Birmingham. He had gone to a great deal of trouble to make the demonstration a success and the Division were very much indebted to him. He would also like to congratulate the Professor on his election as President of the N.V.M.A. He deserved the honour, if any one did, for it was his spade work when Secretary of the "National" that had made its status what it was to-day.

The PRESIDENT, in seconding, said the demonstration had been instructive, as well as interesting, to everyone present. He himself had not yet tried the intradermal test, but after what he had seen and heard that day, he was very much tempted to do so.

The vote of thanks was heartily passed, and

Professor BUXTON, in acknowledgment, said he regarded his visit to Birmingham as a duty as well as a pleasure. His institute at Cambridge was not a private one, but was financed by the State on the understanding that any discoveries which might be made should be communicated to the profession at large. He came amongst them grinding no axe of his own, but to help them, as a public servant, as far as lay in his power.

Mr. Leyshon, who had assisted Professor Buxton in the demonstration, was also very cordially thanked, as were Mr. DeVine for inviting them to Holliday Street Wharf, Mr. Steele-Bodger for procuring the animals for the demonstrations, and Mr. Sower for making all the arrangements.

NOMINATIONS AND ELECTIONS.

Mr. HOBSON nominated Mr. G. Benbow, of Leicester, for membership of the Association.

Mr. ASTON nominated Mr. Gregory, of the Board of Agriculture's staff, resident at Derby.

The following gentlemen, duly nominated at the previous meeting, were now elected members of the Association:—Mr. W. L. Sheffield, of Quorn, and Mr. A. Hamilton, of Baschurch (Salop).

ARRANGEMENTS FOR NEXT MEETING.

The HON. SECRETARY presented the report of the Council, who held a meeting earlier in the day. The Council recommended that the next quarterly meeting be held at Worcester, that Mr. Steele-Bodger be asked to read a paper on his visit to Denmark for the study of abortion, and that Mr. Barker be invited to open the discussion. The Council further recommended that a sum of five guineas be contributed out of the funds of the Association to the Garnett Memorial Fund.

The report was adopted and the recommendations contained therein agreed to.

MR. LIVESEY AND THE "NATIONAL."

Mr. ASTON moved a vote of thanks to Mr. Livesey for all he had done towards bringing the National Veterinary Medical Association to its present state of efficiency and influence. Whatever they might think about his retirement from the secretaryship of the parent body, all must agree that Mr. Livesey had done a great work, and the obligation under which he had placed the profession ought to be acknowledged.

The HON. SECRETARY said he would like to second that. He had been brought into close touch with

(Continued at foot of first column next page)

NOTES AND NEWS.

The Editor will be glad to receive items of professional interest in these columns.

Diary of Events.

Oct. 28th.—Meeting of the Section of Comparative Medicine of the Royal Society of Medicine.

Nov. 5th.—Annual Dinner of the Central Division.

,, 30th.—Notification of changes of address to Registrar, R.C.V.S.

Dec. 1st.—R.C.V.S., Examination Fees (December Exams.) payable.

,, 8th.—R.C.V.S., Written Examination.

,, 10th.—R.C.V.S., Oral Examinations commence.

We understand that some difficulty is being experienced in carrying out the existing Regulations under the Tuberculosis Order. Veterinary Inspectors, are, therefore, requested to forward to the Chairman of the Editorial Committee, N.V.M.A., 10 Gray's Inn Square, W.C. 1, their experience in the working of these Regulations.

(*Continued from previous page.*)

Mr. Livesey over the work of the National, and nobody knew better than he did how unselfishly and ceaselessly Mr. Livesey had laboured to raise the National Veterinary Medical Association to the high position which it held in the professional world to-day.

The vote of thanks was carried unanimously.

SOME INTERESTING CASES.

Mr. BANHAM produced some bones showing a fracture of the lumbar vertebræ. Whilst the animal was on the ground another horse jumped on it. The animal got up apparently uninjured, and afterwards walked to the station, collapsing while being boxed.

Mr. BANHAM also showed the fractured metacarpal bone of a thoroughbred which struck a hurdle with its foreleg whilst racing. The animal finished third, and afterwards walked a mile and a half to the station.

Mr. BROOKE mentioned a case of osteo-malacia which had come under his notice in the course of his dog practice. There was a discharge from the nose and mouth, and he thought at first it was dental trouble. He had sent the case to Cambridge, and was awaiting Professor Buxton's report, which he would be pleased to lay before the next meeting of the Association.

The company had tea together, as usual, before separating.

H. J. DAWES,
Hon. Secretary.

CORRESPONDENCE.

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The Editor does not hold himself responsible for the opinions of his correspondents.

"Professor Glaister's Statement."

TO THE EDITOR OF THE VETERINARY RECORD.

Sir,—Knowing Professor Glaister's wide reputation for meticulous accuracy of statement, I was surprised that his percentages of passes and rejections were inaccurate in the case of two Colleges. I am even more surprised to learn from Dr. Whitehouse's letter in your issue of 10th inst. that unchecked but checkable figures were included in a public statement—even though originally intended for private use only.

It is a pity that while, in the case of the figures relative to the Glasgow students, adjustment was made between those who originally intended to sit and those who actually did sit the examinations, it was not assumed that similar adjustments might be necessary in the case of other Colleges.

The matter is really of no moment, and I had intended letting it pass without comment. Seeing, however, that it has already been the subject of two letters in your columns, I may, perhaps, be forgiven for taking up a few lines of your space to say that the correct percentages relative to students of this College are 69 of passes and 31 of rejections.—Yours faithfully, O. CHARNOCK BRADLEY, Principal.

Royal (Dick) Veterinary College,
Edinburgh.
14*th October*, 1925.

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TO THE EDITOR OF THE VETERINARY RECORD.

Sir,—I feel that if Sir John M'Fadyean had read my letter in reply to Principal Craig published in your issue of the 10th inst., he would have modified his letter of the 17th.

I can, however, make my position a little clearer. We had had outstandingly good results at the July Examinations, and I prepared an analysis of them for the information of my Governors.

Glasgow Veterinary College is out for donations and subscriptions to make good the deficit caused by the withdrawal of the grant from the Board of Agriculture for Scotland, and Professor Glaister considered that some of the figures should be incorporated in his statement. Personally, I was reluctant that comparative figures should be published. You, sir, quoted from *The Scotsman*.

I owed Principal Craig an apology for an error in the basis of calculation, and I made it gladly and without reserve. I cannot see that I owe any to Sir John M'Fadyean for not going into ancient history: my report was for the July examination, which was the best we have had since I have been at the College. In fact, Professor Glaister's statement did not bring out what seemed to me our strongest features.

I base now on the time table for the numbers of prospective candidates and on the *Veterinary Record* for the results, and I estimate roughly for the sake of clearness.

In first class honours Glasgow was awarded one for every 12½ prospective candidates; London one for every 45; and the four Colleges (excluding Glasgow) one for every 125.

Combining first and second class honours, Glasgow was awarded one for every 3½ prospective candidates: London one for every 5½, and the four Colleges (excluding Glasgow) a little better than one for every 7.

The results were due very largely to the fact that Classes A and B contained men of unusual brilliance, but the members of our staff may justly claim that they have at least not impeded the students in their efforts.—Yours faithfully, A. W. WHITEHOUSE, Principal.

Glasgow Veterinary College,
Buccleuch Street, Glasgow.
19*th October*, 1925.

"The Problem of the Tuberculous Cow."

TO THE EDITOR OF THE VETERINARY RECORD.

Sir,—In your issue of the *Veterinary Record* of October 17th, on page 903, I am afraid that the reporter at the meeting of the Sanitary Congress, Edinburgh, has failed to record my remarks correctly in regard to "disposal of re-actors."

What I said was this: "They have got to go somewhere, unfortunately, and in Northumberland there is distinct evidence that these re-actors are passing through our marts and markets and so dangerous has it become, etc., etc., *and asked the auctioneers to set aside a special day for the sale of cows carrying a certificate stating that they have within the past fourteen days been subjected to the tuberculin test by a qualified M.R.C.V.S., and have passed satisfactorily.*"

In Mr. Gofton's reply my point was dealt with when Mr. Gofton instanced the re-infection of a herd *by cows bought in the North of England.*—Yours faithfully, CLEMENT ELPHICK, M.R.C.V.S.

Newcastle-on-Tyne.
19*th October*, 1925.

"The Whole-time Conscience."

TO THE EDITOR OF THE VETERINARY RECORD.

Sir,—In reference to Colonel Brittlebank's criticism of my letter in the issue of 10th inst., I think I may fairly say that it is quite possible for us to argue on the advantages and disadvantages of part-time and whole-time work, for a considerable time, without coming to complete agreement.

Obviously, therefore, I saw no need to comment on his paper and confined myself to the "discussion." Further, I may say that in a public discussion of the kind characteristic of Sanitary Conferences (including various notabilities) I should be inclined to regard Colonel Brittlebank rather as the official than the representative of local authority.

I certainly did not read into Colonel Brittlebank's paper anything which has been attributed to me. In the discussion, however, I am of opinion that reflection was made on the probity of the part-time inspector, and I consider my protest was justified.—Yours faithfully, HUGH P. HOGBEN.

26 Manor Road,
Folkestone.
20*th October*, 1925.

National Veterinary Medical Association of Great Britain and Ireland.

EDITORIAL OFFICE: 10 Gray's Inn Square, London W.C.1.

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